VOLUME LVI APRIL, 1946 NUMBER 4

THE LARYNGOSCOPE

FOUNDED IN 1896
BY
MAX A. GOLDSTEIN, M. D.

PUBLISHED BY
THE LARYNGOSCOPE
640 SOUTH KINGSHIGHWAY ST. LOUIS (10), MO., U. S. A.

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THE
LARYNGOSCOPE.

VOL. LVI APRIL, 1946. NO. 4

ALLERGY IN OTORHINOLARYNGOLOGY AND OPHTHALMOLOGY. A REVIEW OF THE RECENT CURRENT LITERATURE.

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A review of the literature on the subject of allergy from the standpoint of ophthalmology and otolaryngology for the years 1944 and 1945 reveals some additional points of interest. With the introduction of new therapeutic agents, there always exists the possibility of allergic reactions following in the wake of their usage. The urticarial type of reaction, sometimes simulating serum disease, has occurred from the use of penicillin. This drug has also been noted as a cause of contact dermatitis. Similar reactions may occur from the sulfonamides. Many instances of untoward reactions of an allergic or chemical nature have been observed following the use of various types of nose drops.

Improved methods of inhalation therapy employing penicillin and the sulfonamides for the treatment of various bronchopulmonary diseases have been developed.

OPHTHALMOLOGY.

Pyle[1] reports the case of a medical officer in charge of penicillin production who developed a marginal blepharitis and an acute dermatitis of the face. Patch tests with penicillin as it was used and with crystalline penicillin were positive. He also reported that three hospital workers who handled penicillin developed slight itching of the face.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, Feb. 20, 1946.

Silvers[2] reported a case of dermatitis of the eyelids and face in a chemist who had been doing research work on penicillin. Patch tests to sodium penicillin were strongly positive, but no reaction was noted to crystalline sodium penicillin. It was concluded that the contact dermatitis was caused by the impurities present in the commercial yellow amorphous form of sodium penicillin.

Binkley and Brockmole[3] observed two cases of dermatitis in physicians who handled solutions of sodium penicillin. One of the patients had dermatitis of the upper extremities and face. A patch test to sodium penicillin was positive. The second patient developed dermatitis of the face and hands about six weeks after exposure to penicillin. Patch, intracutaneous and ophthalmic tests were negative, but six hours after receiving an intramuscular injection of 60,000 units of penicillin the patient had pruritus of the hands and feet. In both of these cases the dermatitis quickly disappeared after the avoidance of contact with penicillin.

In a group of 90 cases of contact eczema due to nail polish, Dobes and Nippert[4] found that patchy dermatitis of the upper eyelids was the commonest lesion. Patch tests were performed with seven brands of nail polish, including colorless and colored lacquers of each brand. The patients were tested with the common ingredients of nail polish such as the body, plasticizer (resin), solvent, dye and perfume. Positive reactions were noted to resin, dye and nitrocellulose. It was finally concluded that the solvents in nail polish are usually the cause of the dermatitis, and patch tests are not always positive.

In a group of 36 cases of dermatitis of the eyelids, Hazen[5] noted that the upper lids were involved, and in about 50 per cent one or both lower lids were also affected. Most of the patients were young females. Suspected contractants were eliminated regardless of the result of the patch tests. He pointed out that the eyelids are much more sensitive than the other parts of the skin and that they may be affected by substances that give negative patch test reactions on the body.

The most common forms of dermatitis of the eyelids are seborrhea and cosmetic dermatitis, nail polish being the most frequent offender. Other offending contactants reported among the 36 cases included nail polish, orange peel, carbon paper, wave set lotion, hair dye, face powder, dog hair, cold cream, perfume and ammoniated mercury.

Twenty-six patients with nail polish dermatitis were studied by Keil and Van Dyck.[6] None of the patients was found to be sensitive to nail polish removers. Among 26 patients patch tested with toluene sulfonamide resin, 25 showed striking positive reactions. Negative reactions were noted on 15 control subjects.

Among 54 cases of conjunctivitis and keratitis of allergic origin Linhart[7] found that four patients had contact dermatitis of the eyelids, and 50 had conjunctivitis. The chronic recurrent type of conjunctivitis was characterized by a velvety, boggy appearance of the palpebral surface and the presence of a stringy mucoid discharge. Only three patients showed the typical vernal catarrh. Corneal involvement was noted with the slit lamp in 17 patients who seemed to have only conjunctival involvement by gross examination. Positive skin reactions to many allergens were found. Good results were obtained from hyposensitization and local treatment.

Castellanos[8] reports his observations on ariboflavinosis as a possible cause of vernal conjunctivitis in a group of 105 patients. The patients were given one to three tablets containing 1 mg. of riboflavin daily during the hot weather. Symptomatic treatment in the form of eye drops was also given. Large quantities of milk were given because of its high riboflavin content. Thirty-five per cent of the patients reported improvement within three to four days, and in the remainder there was improvement within 10 to 15 days. It is believed that the riboflavin deficiency during the hot weather is the result of a more rapid destruction of the vitamin by the ultraviolet rays of sunlight.

Rolett[9] reports a case of juvenile cataract associated with dermatoses in a 20-year-old male. A blood eosinophilia of 16

per cent was noted. The skin changes had preceded the cataracts by a period of several years.

Schwartzman[10] states that there is little immunologic evidence that a sympathetic ophthalmia is allergic in nature. He believes that there is a great deal of evidence to indicate that atopic sensitization plays a part in vernal catarrh; however, there are strong suggestions that some virus also plays a part. He feels that the phenomenon of local tissue reactivity to bacterial filtrates may explain certain ocular diseases.

DIAGNOSTIC TESTS.

Goldman and Goldman[11] report a method of contact testing of the buccal mucous membrane for stomatitis venenata. They used a so-called "rubber suction" technique. A soft black rubber suction cup, such as is used to fasten display advertisements by suction to surfaces was used. A small amount of collodion is placed in the central depression area and then a piece of cotton is packed on top so that the depression is filled. The material to be tested is placed on the cotton. Positive reactions were noted after as little as five minutes of contact. The average contact time was 20 to 30 minutes. Positive reactions were obtained with toothpaste, plate cleaner, oil of lavender, and mercury. One patient with a cashew nut stomatitis and dermatitis showed a positive patch test with cashew nut oil but was not tested bucally. In another series of cases mucous membrane reactions were noted in cases of contact dermatitis without stomatitis. It was noted that individuals who were skin sensitive to nickel usually had a hypersensitivity of the buccal mucosa to the same metal.

Pipes[12] noted that in a series of 370 consecutive allergic patients, 39, or 9 per cent, gave a history of initiation or aggravation of allergic symptoms by tobacco smoke; 47, or 13 per cent, showed positive reactions to tobacco smoke extract. In 19 patients the positive skin reactions were correlated with the clinical history. Passive transfer studies with tobacco sensitive and tobacco smoke sensitive sera showed that positive skin reactions to tobacco smoke extract do not completely desensitize sites to each other. He believes that

allergy to tobacco smoke may be a distinct entity exclusive of allergy to tobacco. He suggests the use of both of the above extracts in routine testing.

PHYSIOLOGY.

Ralston and Kerr[13] studied the vascular response of the nasal mucosa to thermal stimuli and also made some observations on skin temperatures. They found that local cutaneous chilling was followed by a drop in nasal temperature which returned to normal within a few minutes. Local cutaneous warming was followed by a transitory reflex temperature drop which was later followed by a permanently elevated nasal temperature as long as the stimulus was applied. No difference was noted between the temperature reactions of hypersensitive and normal individuals. The subcutaneous injection of 0.75 ml. of epinephrine was followed by a drop in the nasal temperature with shrinkage of the nasal mucous membrane and an increase in the nasal chamber volume. In these experiments there was no difference between the hypersensitive and normal individuals.

Fabricant[14] reported his observations on the clinical significance of the pH of the superficial mucous membranes of the head. The pH of the nasal secretion was found to fluctuate from 5.5 to 6.5 in the normal nose. The nasal pH was also found to vary with sleep, rest, diurnally and nocturnally, and can be changed not only by infection but also by emotional factors. The application of ice to the side of the nose produces a change to alkalinity, and heat produces a shift to the acid side. In the early stage of acute rhinitis the pH of the nasal secretions becomes more alkaline. An alkaline reaction was also noted in the active stages of allergic rhinitis. Because of the high alkalinity of sodium sulfathiazole solutions, he condemns their indiscriminate use in the nose.

Dietz[15] states that the pH of the nasal mucosa probably plays an important part in the defense against bacterial and viral infections. Special glass electrodes were constructed for measuring the nasal pH of hamsters, ferrets and rats. He states that the temperature at which the readings were made

proved to be a very important factor and was kept constant at 35° C. The normal pH was found to be 7.2 in the animals examined, which is about the same as that found in man.

Fabricant[16] made the observation that lysozyme, which has the property of dissolving certain bacteria, is most effective in an acid pH. It is most active in the slightly acid nasal secretions of the clinically normal nose and loses much of its activity in the alkaline nasal secretions accompanying the common cold. He found that a fluctuation in pH of the nasal secretions affected the bacterial flora of the nose and sinuses. Eosinophiles in the secretions in the allergic patient disappeared as the pH fell to the acid side and reappeared as the pH returned to the alkaline side.

Hilding and Essex[17] conducted a series of experiments on dogs in an attempt to explain the so-called vacuum headache. Upon the injection of mucus into the frontal sinus, a sharp rise in pressure (+270) occurred. The pressure began to fall in two minutes and became negative in five or six minutes. Upon reaching the lowest point (—59.5) within 47 minutes, it remained negative until the experiment was completed two hours after injection. It was presumed that the negative pressure was caused by the removal of mucus through the ostium by ciliary activity. Because the ostium was occluded by the mucus, air could not replace it as it was removed. Similar experiments were conducted on the detached heads of animals in order to show that the air could not have been absorbed through the blood stream.

THE EFFECT OF VARIOUS DRUGS UPON THE NASAL MUCOSA.

The effect of penicillin on cilia was investigated by Proetz.[18] Strips of ciliated respiratory epithelium from a rabbit were suspended in a bath and subjected to various concentrations of penicillin at 30° C. for various time periods. He found that the penicillin solutions recommended for local application to the nose and sinuses (250 units per milliliter of isotonic saline) have no appreciable adverse effect on the cilia. Stronger concentrations tended to impair ciliary action.

Spencer[19] reports the case of a patient who became hypersensitive to ephedrine following the use of an oily preparation of nose drops. The irritation consisted of an acute erythematous papulovesicular and scaling eruption around the nostrils and upper lip. Lesions also appeared on the forehead, neck, trunk, and upper and lower limbs. Patch tests with the ingredients of the oily inhalant menthol, eucalyptol and camphor were negative, but a positive reaction was noted to ephedrine.

Kully[20] discusses the use and abuse of nasal vasoconstrictor medications. In general he found that the prolonged use of the various drugs of this type produces unfavorable effects. He further states that sensitivity to nasal medications indistinguishable from a true allergic reaction may occur in the course of a vasomotor rhinitis.

Butler and Ivy[21] studied the effects of nasal inhalers on the erectile tissues of the nose. Two hundred sixty-six tests were performed with various types of amphetine and menthol inhalers. Relief of obstruction was noted in about 15 minutes. Various aromatic ingredients in inhalers other than menthol were found to produce pronounced congestion. Pure amphetine was much more effective in relieving nasal congestion than the commercial preparation.

Sternberg[22] suggests that the use of vasoconstrictors in vasomotor rhinitis and hay fever should be used with discretion. He found that in many patients the nasal discharge and obstruction were increased by the excessive use of these drugs. He found also that the membrane may remain continuously waterlogged until all treatment has been discontinued.

Craver, Chase and Yonkman[23] noted that privine elevates the blood pressure of anesthetized dogs about one-third as much as an equal weight of epinephrine. It lacks a subsequent depressor phase. Yohimbine and ethyl yohimbine drugs which paralyze sympathetic nerve endings diminish the pressor response to privine but do not bring about as marked a depressor response as they do with epinephrine. No

change in blood pressure was found when about seven times the human dose of privine was instilled into the nose of dogs.

Emerson[24] found that in dogs privine elicits a pressor response which is not appreciably influenced by atropine or cocaine. He found that cardiac irregularities and Cheyne-Stokes respiration may occur when large doses of privine are given intravenously to dogs anesthetized with sodium pentobarbital and sodium barbital. The depressor response to epinephrine is increased following privine medication.

In studying the problem of nasal medication with particular reference to privine hydrochloride, 0.1 per cent, Gollom[25] noted that in a period of one year he saw more than 30 patients who had become practically addicted to the use of this drug for the relief of nasal obstruction. Most of the patients began the use of privine for the nasal congestion of colds or during the hay fever season. Complete clinical relief was obtained three to 10 days after the drug was discontinued. The author advised that privine should never be used longer than a period of a few days at any one time and that this drug should not be sold without a prescription.

According to Feinberg and Friedlaender,[26] privine hydrochloride nose drops cause a rebound congestion of the mucosa. They report that in a group of 75 patients, nasal congestion was aggravated or maintained by privine. Relief followed withdrawal of the drug. The undesirable effect of this drug has not been definitely established but it may be due to one of the following: *a.* the presence of a vasodilator substance, *b.* allergy to the drug, *c.* chemical irritation, or *d.* a vasodilatation following an intense vasoconstriction.

In the study of the local use of sulfonamides in nasal and sinus infections, Fabricant[27] found that they cause destruction of the cilia, an impairment of ciliary function, and a deviation of the nasal pH. He, therefore, condemns their indiscriminate use.

It should be pointed out that among patients sensitive to sulfonamide preparations the spraying of the nose with this

drug may excite a generalized dermatitis or some other allergic manifestation.

Randolph and Rawling[28] reported two cases of bronchial asthma following sulfonamide therapy. In the first patient, status asthmaticus developed on the seventh day following the use of a sulfathiazole nasal spray. There was no history of any previous allergic manifestations. A trial dose of the drug administered after the patient had been symptom-free for one week resulted in the recurrence of the asthma. The second patient was an allergic individual. He developed asthma on the first day following a second course of sulfathiazole treatment.

INHALATION THERAPY.

Applebaum[29] reports his observations on the use of the inhalation of a nebulized solution of sodium sulfathiazole on 50 patients with various types of infectious lesions of the bronchi (infectious bronchial asthma, bronchitis, bronchiectasis, etc.). Oxygen flowing at a rate of 4 L. per minute was passed through a 5 per cent sulfathiazole solution in a nebulizer. The patients holds the nebulizer between his teeth for a period of 20 minutes. Treatments were given three times daily for 10 consecutive days. Forty-three cases (86 per cent) showed definite improvement. There was definite improvement in the asthmatic group.

Mutch[30] reports his observations on the inhalation of sulfonamide mists by the use of a Collison inhalation apparatus. He noted that bronchiectatic patients absorbed more than normal. Among the dyspneic patients the amount absorbed increased as the ventilation rate rose. Inhalation therapy was also discussed.

Chu[31] and his co-workers reported the absorption of penicillin from the nose and alimentary canal. In dogs, penicillin was absorbed from the nose or mouth about one-fourth as much as from intramuscular injection. In man it was found that the intranasal absorption of penicillin solution containing 100,000 units per cc. could be tolerated without significant irritation if introduced by spraying. When the same amount was dropped into the nose it caused irritation. The blood

concentration of penicillin following its administration by intranasal spraying was very low and could not be regarded as adequate for systemic treatment.

Barach[32] and his co-workers report their observations on the treatment of bronchial asthma, chronic bronchitis, bronchiectasis and lung abscess by the inhalation of penicillin aerosol. A special type of nebulizer which delivers aerosol only on inspiration was used. Twenty patients with pulmonary and bronchial infections received an average of 200,000 units of penicillin daily for an average period of 10 days. Three patients with bronchial asthma and bronchitis, one with lung abscess, one with bronchiectasis, and 10 with emphysema and pulmonary fibrosis were benefited. Five patients with closed lung abscess, bronchiectasis and pulmonary fibrosis were not benefited.

Stookey[33] and his associates report their observations on the use of penicillin in 21 patients with chronic bronchitis and bronchiectasis who were studied Roentgenologically and bacteriologically previous to the institution of penicillin treatment. Staphylococci were the most consistent and persistent pathogens found. The incidence of streptococci was very low. The most common finding was the association of a staphylococcus and streptococcus viridans. Each patient received an average of 1,000,000 units of penicillin either intramuscularly or by continuous intravenous drip over a period of eight to 10 days. There was a decrease in the number of colonies of hemolytic streptococci and staphylococci and a slight reduction in the growth of nonhemolytic organisms following treatment. There was no definite change in the volume of sputum. It was concluded that about 20 per cent of individuals suffering from bronchiectasis, chronic bronchitis or chronic cough may be benefited by penicillin therapy. Those with chronic bronchitis responded most favorably to penicillin. The response to penicillin in favorably affected cases was almost immediate, with a disappearance of the morning sputum and cough. Penicillin had little effect in cases of true bronchiectasis. Recurrences usually followed the treatment since no permanent immunity was established.

GENERAL CONSIDERATIONS AND TREATMENT.

The frequency of allergy in orthodontic patients was investigated by Straub.[34] Among 104 patients, 41, or 39.4 per cent, were definitely allergic; 13, or 12.5 per cent, were considered as borderline; and 50, or 48.1 per cent, entirely negative. Dentofacial anomalies were noted in 61.5 per cent. Straub suggests that allergy with nasal obstruction is definitely related to dentofacial anomalies. Seventeen per cent of the allergic patients showed marked gingivitis of possible allergic origin. He finally concludes that a large number of orthodontic patients are allergic and that the incidence of dentofacial anomalies can be reduced by the early recognition and correction of chronic nasal or respiratory allergy.

Blank and Levitt[35] report their observations on the military aspects of allergic rhinitis and found an incidence of 6.3 cases per 1,000 men. Uncomplicated ragweed hay fever occurred in 303 men, or 41 per cent of the 741 patients. Among 155 patients with perennial rhinitis, almost all had an inhalant etiology. Foods were found to be the only cause in 12 cases. Thirty-two patients in this group had nasal polypi.

Laub[36] reports his observations on the relationship of the endocrine glands to vasomotor rhinitis. Attention was particularly directed to those patients who had symptoms during adolescence, the climacteric or during the eighth decade. The administration of small doses of testicular or ovarian extract was found to improve the condition. Four patients with vasomotor rhinitis, two with concomitant asthma, were presented to illustrate the excellent results obtained with endocrine therapy.

Archibald[37] reports his observation on the use of ethylene disulfonate and distilled water in the treatment of a group of 45 allergic children suffering from hay fever, asthma and eczema. The patients were divided into three groups: Group I, 18 children received ethylene disulfonate; Group II, 18 children received distilled water; and Group III, nine children received, first, ethylene disulfonate, and later, distilled water after the symptoms had recurred. The results of this investigation indicate that ethylene disulfonate is no

more effective than other forms of nonspecific therapy, such as milk, peptone, vaccines or distilled water. It was finally concluded that there is no justification for the use of ethylene disulfonate in allergic children.

Hansel[38] reports his experiences on the use of small dosage dust and pollen therapy in the management of respiratory allergy. Stock dust extracts were prepared from the following ingredients: vacuum cleaner sweepings, old mattress stuffing, automobile upholstery vacuum collections, kapok, feathers, jute and ozite. Animal dander, silk, pyrethrum, tobacco or specific environmental dusts were added to the stock dust as indicated. In some cases mold extract made from old feed mill dust was added to the dust extract or used alone. In deciding the initial dose for treatment it was found that the skin test was not a reliable indicator. The plan finally followed was that of treating the patients according to the relative degree of the clinical symptoms, the most severe patients receiving the smaller doses. When satisfactory relief was obtained from any given dose, no further increase was made. It was found that the optimum dose ranged from 0.10 to 1.0 cc. of the 1:100,000,000 dilution to 0.10 to 0.50 cc. of the 1:100,000 dilution. Patients with summer hay fever and asthma who showed negative skin test reactions to pollens were treated satisfactorily by the injection of the mold extract. Vernal conjunctivitis also responded satisfactorily to the same extract. In the treatment of hay fever patients, small dosages similar to those used in the treatment of dust patients was found to give satisfactory results. Either subcutaneous or intracutaneous methods were used.

In discussing nasal allergy for the practicing rhinologist, Shambaugh[39] points out that chronic sinus infection and 90 per cent of chronic nasal infection can be shown to have an underlying allergic factor. He considers house dust sensitivity the most important factor. He recommends dust therapy using dilutions from 1:1,000 to 1:1,000,000.

Rainey[40] reports his observations on the treatment of 60 patients with true Ménière's syndrome by the administration

of a series of three intravenous injections of histamine phosphate within a four-day period. Fifty-three of these patients had had major attacks. Excellent results were obtained in 49 cases. Twenty-five per cent of the 53 cases had a recurrence of symptoms within four to 12 weeks. These patients received a second series of injections, and in some instances a third.

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THE SELECTION OF HEARING AIDS.[1]
PART II.

(Continued from March, 1946, issue.)

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V – THE LIMITATIONS OF VARIOUS TESTS PROPOSED FOR THE "FITTING" OF HEARING AIDS.

In an earlier chapter we expressed the opinion that objective tests for the "fitting" of hearing aids are either too arbitrary, too elaborate, or too inconclusive to be made the basis of a general routine procedure. In this chapter we present briefly the reasons behind this sweeping (and unorthodox) opinion. It is worth noting, however, that at the inception of the project, before the problem had been fully analyzed, we accepted without question the principle of selective amplification as the basis for the fitting of hearing aids and shared the current opinion that a satisfactory objective method of selecting the "best" instrument for each patient could be found. Several of the tests to be discussed were originally suggested by members of the NDRC project.

One of the authors was stationed for several months at Deshon General Hospital, working in close collaboration with the Aural Rehabilitation Service, gaining first-hand experience with the practical aspects of the problem. The officers of the Aural Rehabilitation Service at Deshon General Hospital have cooperated most generously with us, both by con-

1. This research was initiated at the Psycho-Acoustic and Electro-Acoustic Laboratories of Harvard University under Contract OEMsr-658. This contract between the Office of Scientific Research and Development and Harvard University was supervised by NDRC Section 17.3. The work has been completed under Contract N5ori-76 between the Office of Research and Inventions, U. S. Navy, and Harvard University. Except for minor numerical changes based on recent experiments and for the omission of some historical material, this article is virtually a reprinting of report "PNR-7" issued by Psycho-Acoustic Laboratory, Harvard, dated 31, December 1945.

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ducting clinical research aimed to develop and test new methods and in sharing fully with us their own opinions and experience. We are similarly indebted to the Army Aural Rehabilitation Services at Borden General Hospital and at Hoff General Hospital and to the Navy Aural Rehabilitation Service at the U. S. Naval Hospital at Philadelphia for careful and thorough-going criticism of our various suggestions and of our final point of view. With respect to some of our final conclusions there may still be honest differences of opinion. If so, it is hoped that independent evaluations of the more promising methods will be published by the Aural Rehabilitation Officers who have developed and applied them under the stress of the great urgency of their clinical responsibilities.

It must also be clearly understood that in criticizing current methods adversely from a scientific point of view we do not imply that the patients at the hospitals have been badly served. We are convinced that they have generally been given instruments well suited to their needs. The worst that can be said is that some of the methods employed were more elaborate than we now believe necessary, and that when an instrument was chosen by the methods employed it could easily have amounted to chance selection among several instruments, any one of which would have served the patient equally well. Furthermore, some of the methods serve usefully to eliminate the less satisfactory models, and with proper recognition of their limitations, and with simplification of the routine, these methods may well be retained.

"Audiogram Fitting," and the "Aided Audiogram."

These methods and the theoretical basis for them have been adequately described and criticized in Chapter III. "Audiogram fitting" undertakes to select an instrument on the basis of some relation between its frequency characteristics and the patient's audiogram. An effort is made to compensate for the patient's particular auditory impairment by giving him an instrument that selectively amplifies those frequencies for which his sensitivity is most impaired. The method is quick,

particularly if charts are prepared in advance, as has been done by certain manufacturers, to indicate which model is recommended for various types of audiograms; but the errors in the basic assumptions have already been pointed out.

The "aided audiogram" meets some of the more obvious shortcomings of the simple "paper fitting," but requires very good technical facilities if serious additional difficulties are to be avoided. Even with perfect facilities the basic fallacies in the method are still present and no great confidence can be placed in it.

"Residual Hearing Loss," and "Gain for Speech."

The concept of residual hearing loss, either for pure tones or for speech, is that when a hearing aid is set for ordinary use, presumably for conversational speech, it is possible to measure the threshold of speech (or pure tones), and then to compare this threshold either with the normal, to determine the "residual hearing loss," or with the patient's unaided threshold to determine the "gain for speech" provided by the instrument. The possibility that this measurement may differentiate usefully among hearing aids rests on certain assumptions, particularly in relation to the setting of the gain control.

The *"residual loss for pure tones"* is obviously a special case of the "aided audiogram" and is therefore subject to all the criticisms raised for the pure-tone method, as well as to the additional uncertainties regarding the procedure to be used for setting the gain control. No further special comment is necessary.

The *"residual loss for speech"* offers several advantages over the pure-tone method. Standing waves are not a problem in a reasonably sound-treated room because speech is a series of continually changing frequencies and intensities. Only one threshold need be measured, the threshold for speech, instead of the six or eight for an audiogram. The threshold for speech is a realistic end-point with clear practical significance, and it is definite and quantitative if a uni-

form sample of speech is employed. The normal threshold of intelligibility lies some 15 or 20 db. above the normal threshold for pure tones, so that the problem of masking by ambient noise, although still serious, is within the reach of practical solution.

Theoretical Basis.

The rationale of discriminating between instruments on the basis of their "residual loss for speech" is as follows: The patient is instructed to set the gain control to give him a "most comfortable" loudness when listening to conversational speech. He presumably adjusts for a comfortable overall loudness rather than for the clarity or quality of the received speech. If the instrument uses its output power effectively in transmitting speech, there should be a relatively large range between the speech-input level at which the comfort setting is made and the threshold at which the speech is only just understood. But if the instrument is ineffective, perhaps because it delivers a large amount of energy in a narrow range of frequencies, the most comfortable setting will have been based on the loudness of the strongest part of the spectrum. There will be, therefore, a narrower range between the input level at which the setting is made and the threshold level, because as the intensity is lowered the speech will become unintelligible as soon as the less efficiently transmitted frequencies fall below the level at which they can contribute to the intelligibility of speech. Therefore, the instrument for which the threshold for speech is lowest (*i.e.*, nearest the normal threshold) and shows the smallest "residual loss" is presumably the most effective instrument for the patient.

If the initial assumptions are granted, this argument appears to be theoretically sound even though *the test is only an attempt to measure indirectly the relative "goodness of fit" of the instrument,* and not, as is often supposed, the absolute sensitivity that the instrument provides.

Importance of Gain-Control Setting.

The theoretical validity of the method rests on the ability of patients to make consistent settings of the gain control

when they are instructed to set them to "the most comfortable level." If they do not, any true differences in the effectiveness of various instruments may be canceled or even reversed by the variability of the patient's setting of the gain control. It is assumed that the speech for which the "comfort" settings are made is kept at a constant level. (Recorded continuous speech, delivered at a level about 60 db. above .0002 dyne/cm.^{2}, or 40 db. above the normal threshold of intelligibility, serves well for the average patient.)

Statistical analysis of the agreement between two "comfort" settings made by each of 40 patients at Deshon General Hospital showed a standard deviation of 3.7 db. in the aided threshold subsequently determined by a test very similar to Auditory Test No. 9. The Aural Rehabilitation Officer who supervised the tests and the statistical analysis expressed the following opinion: "Real differences between instruments are often discovered when this method is used. However, the results for each patient must be assessed in terms of the relations between the scores he gives. In practice the consistency of two settings made by a particular patient with the same instrument is a guide to the reliance that is to be placed on differences for that patient between measures made with different instruments. The consistency of the patient's setting can be assessed and interpretation of the significance of differences between instruments made in terms of 'statistical norms.' No definite rule can be given to the amount of difference which is considered significant. This depends upon the patient's individual consistency. When this precaution is taken, some patients do not yield significant differences. Residual loss is in these cases not a critical differential."

Our own skepticism as to the possibility of obtaining sufficient consistency of the gain-control settings by patients was increased by a set of experiments performed by one of us, partly at Deshon General Hospital and in part at the Psycho-Acoustic Laboratory. The results indicated a degree of variability, both for hard-of-hearing patients and for normal subjects, so great as to vitiate any differences which might reasonably be expected to appear between instruments.

Efforts to devise a more satisfactory procedure for setting the gain control were unsuccessful. Among the methods tried were:

1. *Maximum Gain-Control Setting.* This control setting is reproducible; but acoustic leakage and consequent feedback frequently make such a high setting unusable, and few patients habitually employ the maximum setting of their instruments. Furthermore, with maximum usable setting it is often impossible to measure the true gain for speech because the threshold is likely to be limited by ambient noise, and not by the hearing aid.
2. *A Compromise Setting,* to give the most comfortable single setting for listening to two different input levels, either 20 or 40 db. apart. The reproducibility of setting was improved somewhat by this more elaborate procedure, but some subjects still remained quite erratic — and for such erratic subjects the method of residual loss is clearly inapplicable.

Our second reason for doubting the real value of the method of residual loss is the lack of any clear-cut evidence that the method actually does discriminate usefully among present-day instruments. It seems clear that the method would detect and reject any very inferior instrument, but it is assumed that such instruments would be rejected by some general preliminary screening. In Chapter III it has been pointed out that many of the instruments examined at the Electro-Acoustic Laboratory do not differ greatly from one another, and the difficulty of establishing criteria and experimental conditions which might demonstrate the importance of the slight differences has also been emphasized. There is at present no experimental or adequate clinical validation in terms of some independent criterion (such as articulation scores, quality judgments, or patient's preferences) for the method of residual hearing loss as a basis for selection. Furthermore, the experimental results with the Master Hearing Aid do not suggest that small differences in the frequency characteristics of instruments are actually of great significance for the large majority of hard-of-hearing subjects.

We believe, in summary, that the accuracy and usefulness of the method of residual hearing loss is seriously limited. In some cases it shows clear and obviously significant differences between instruments, but we believe that these differences can be demonstrated as reliably by simpler methods, such as the measurements of the input range of intelligibility, *i.e.*, the range of input levels over which the intelligibility of speech is maintained.

The Input Range of Intelligibility ("Operating Range").

The test of "input range of intelligibility" is sometimes called the test of "dynamic range" or "operating range." One form of this test is so similar to the method of residual loss for speech that the two tests are easily confused, although their rationales are quite different. The objective is to insure that an instrument provides a useful operating range of at least 40 db. That is to say, the instrument must render faint speech intelligible, and speech 40 db. louder must also be intelligible with the same gain-control setting. The test is not based on considerations of selective amplification but on acoustic gain and tolerability. It was originally proposed as a screening test to reject any instruments that are clearly unsuited to the patient, and to detect any unusual difficulty that he may have with respect to necessary acoustic gain or to his tolerance for high acoustic output.

The setting of the gain control is not critical. Either a "most comfortable" or a "maximum usable" setting, or any intermediate setting may be used. Speech (either connected discourse or test sentences or the spondaic words of Auditory Tests Nos. 9 and 14*) is delivered at conversational level, and it is ascertained that the patient understands it without difficulty. If the material is not understood at this or any other gain-control setting the "operating range" for the instrument is zero.

If the test material can be understood the level of the input speech is reduced until the patient's threshold is reached, or else until the speech becomes so faint that it would normally

*See Psycho-Acoustic Laboratory report, "Recorded Auditory Tests for Thresholds of Words and Sentences," in preparation.

be masked by ambient noise in most practical situations. This limiting level may conveniently be taken as 20 db. above the threshold of intelligibility for normal ears in quiet listening conditions, *i.e.*, about 40 db. SPL when measured with a VU meter. The absolute level chosen as the limit is obviously arbitrary, but it must be standardized. The level of input speech is then gradually increased until it is 40 db. above the level chosen as the lower limit of the test. This will be at about 80 db. SPL and corresponds to loud speech at about one meter. It is expected that this loud speech will be both intelligible and tolerable, but the patient's threshold either of intelligibility or of discomfort will sometimes be reached at a lower level.

This test does not discriminate among "adequate" instruments which are both intelligible and tolerable over the 40 db. input range, *but if the operating range is less than 40 db. the test is critical. In this case a difference of 3 db. or more between instruments is probably a legitimate basis for choice.*

A variant of this test is to begin at the lowest input level to be used, *i.e.*, the standard weak speech 20 db. above the normal threshold of intelligibility, and to instruct the patient to set the gain control so that the speech is just clearly intelligible. Then the level of speech is gradually increased as before. The exact procedure chosen will depend on the intelligence of the patient, his degree of deafness, and the preference of the tester.

One form or another of this test is strongly recommended, provided its fundamental limitation is recognized, namely, that *it is not reasonable to extend the test into the unrealistic ranges of very faint or very loud input levels.* Exactly where the upper and lower limits should most appropriately be placed has not been determined experimentally, and there is therefore an arbitrary element in the test in its present form.

Tests of Tolerance.

The test of adequate operating range introduces the concept of tolerability. In general an instrument should be chosen which does not cause the wearer serious discomfort, even

when used with maximum gain setting and high input levels. It has been pointed out that the maximum acoustic output of an instrument is definitely limited by its power-handling capacity, independent of the gain setting, and also that it is desirable to choose a high "limiting" or "clipping" level, close to but not encroaching on the patient's threshold of discomfort, in order to minimize distortion.

In theory a test of tolerance is very simple. A hearing aid is put on and speech (or noise) is delivered at a high level. A sound-pressure level of 100 db. is sufficient to drive most instruments to the limit of their acoustic output, regardless of the gain-control setting. If the maximum causes discomfort the instrument is presumably too powerful and a less powerful instrument is selected. Such a test can in principle be used as a simple objective "screen" to eliminate unsatisfactory instruments — but there are serious psychological objections to any such crude test of tolerance.

In practice it is important to approach the threshold of discomfort with caution. The patient must be prepared in advance with careful explanation, and the sound level must be increased gradually so that he may have ample opportunity to signal any discomfort. Carelessness on the part of the tester at this point may cause a very unfavorable psychological reaction and perhaps prejudice the patient against the use of any hearing aid. Some patients are surprisingly sensitive to loud sounds when they first try a hearing aid and the tester must be on his guard to detect such cases in the preliminary trials when the instruments are first demonstrated.

Fortunately, the threshold of discomfort (and also of tickle and pain) almost always rises as the patient becomes accuctomed to loud sounds,* and after a period of indoctrination with a low-powered instrument he will usually accept readily an instrument which on first trial seemed intolerable. In fact, it has been suggested that the patient's tolerance should be deliberately increased by a systematic course of exposure to noise at a level slightly below his threshold of

*Central Institute for the Deaf report, "Thresholds of Discomfort, Tickle and Pain in Normal and Hard-of-Hearing Ears," in preparation.

discomfort for a period of several minutes on three or four successive days.* This procedure has not yet been given systematic clinical trial, but seems worthy of very serious consideration.

In any case, it is generally recognized that *no test of tolerance should be considered final until after the patient has had a considerable period of indoctrination* in the actual use of a hearing aid. With many patients there is no problem of tolerance with present instruments, but with others the problem is critical. The test may serve to eliminate unsuitable instruments.

It is not appropriate to enter here into further clinical details and precautions of practical routine. It is enough to emphasize, first, the importance of tolerance tests; second, the importance of indoctrination; and finally, the importance of full consideration of the psychological reactions of the patient.

Articulation Tests (Word or Sentence Intelligibility).

Tests of the ability to understand the spoken word are generally recognized as the most realistic, valid, and (when properly performed) the most sensitive tests of auditory function. They have, therefore, been widely employed in experimental comparisons of all sorts of communication systems, including hearing aids. Most articulation tests are, unfortunately, rather time-consuming and also require rather elaborate instrumentation or highly trained personnel. On the other hand, some form of intelligibility test is required if we are to determine either "residual loss for speech" or the "operating range" of an instrument. It is, therefore, desirable to consider briefly the several types of articulation test and to point out the desirable features and the limitations of each. We shall not be concerned with details of instrumentation or procedure, which are adequately treated elsewhere.†

In an objective articulation test the subject gives evidence that he has understood the test words or sentences either by

*Central Institute for the Deaf report, "Thresholds of Discomfort, Tickle and Pain in Normal and Hard-of-Hearing Ears," in preparation.

†Fletcher, H., and Steinberg, J. C.: Articulation Testing Methods. Bell Sys. Tech. Jour., 8:806-854, 1929, and Suppl. to Jan., 1930, Jour. Acous. Soc. Am., 1-97.

repeating or writing them, by marking a check list, or by responding correctly to directions or questions. With an honest and intelligent subject the simple statement that he understands without undue effort the sense of connected discourse may be sufficient for rapid exploration.

The ability of a listener to understand speech, whether it be syllables, words, sentences, or connected discourse, depends not only on the hearing of the listener and the difficulty of the material used but also on the intensity of the speech as it reaches his ear. (If a hearing aid is used the output intensity obviously depends upon the setting of the gain control as well as on the level at which the speech is delivered to the instrument.) The relation of the percentage of items correctly understood to the intensity of the speech is variously termed a "gain function" or an "articulation curve." The form of this curve is usually sigmoid, rising from the threshold at which some one item is first understood to a maximum or plateau which may or may not correspond to 100 per cent accuracy.

Purposes of Articulation Tests.

Articulation tests may be used in either of two ways: to determine *1.* a *threshold* of some sort, usually the level at which 50 per cent of the test words or sentences are correctly understood, or the lowest level at which the sense of connected discourse may be followed easily; or *2.* the *maximum percentage* of items which the listener can understand at the most favorable intensity, *i.e.*, at the maximum of the articulation curve. It is important to distinguish these two uses, since *a test designed to measure a threshold accurately is usually unsuited to the measurement of maximum scores, and vice versa.*

Threshold of Intelligibility.

The material for a threshold test is chosen for its homogeneity. The items are made as nearly equal in difficulty as possible so that their intensity is the determining factor for intelligibility. The articulation curve rises steeply, and the

position of the threshold on the intensity scale can be readily and accurately determined.

Since the threshold at which speech is understood depends, among other things, on the setting of the gain control, it is obvious that a simple determination of threshold is not an adequate basis for selection of a hearing aid. A threshold test is significant only as part of some more elaborate routine, such as the determination of the operating range as described above.

Maximum Articulation Score.

The material for a test of maximum score, a "discrimination test," includes both difficult and easy items and is usually chosen to sample widely but fairly all the speech sounds of the English language. The items necessarily differ individually in difficulty, but care can be taken that the *groups of items* constituting different word lists or sentence lists are equivalent to one another.

The maximum articulation score may serve as a legitimate basis of choice provided *significant* differences in the performance of instruments are found. (Differences of 5 per cent or less are usually due to chance factors and are not reliable, even with practiced subjects.) It is tempting to base a choice on any difference in score, no matter how small, but this procedure is not legitimate. It must be determined in advance for each test what is probably a significant difference of scores, and the results must be interpreted with due regard to the intelligence, education, degree of cooperation, and apparent consistency of performance of each patient.

The maximum score must be determined in such a way that loudness is not a determining factor. Speech is delivered at an average conversational level, properly standardized and monitored. The patient is instructed to set the gain control so that the words come to him "loudly and clearly, but not so loud as to cause discomfort." The object is to insure that further increase in loudness would not cause an improvement in his score, *i.e.*, that he is really getting the maximum intelligibility that the instrument can give him.

If a patient is not too severely hard of hearing it is likely that not one but several instruments will give him a very high articulation score, say, 90 or 95 per cent on single words. If the maximum scores are over 90 per cent the differences between scores are not likely to be significant. In this situation the articulation test can be made more discriminating by using more difficult material, such as nonsense syllables; but it is important to recognize that if a patient can achieve a score of 90 per cent on a well chosen word list (such as the PB lists, to be described below) his performance is nearly up to the normal standard of about 98 per cent, and he will have no difficulty whatever in understanding ordinary connected discourse. In other words, the performance of the instrument may then be considered "adequate" on this test from the practical point of view. In fact, it is possible to follow conversational speech quite readily under conditions which allow a score of only about 50 per cent on the PB word lists.

Choice of Articulation Tests.

The speech material used for articulation tests or tests of intelligibility (or of tolerance) may be either connected discourse, or lists of sentences, words, or nonsense syllables. The choice depends on the particular objective of the test, the time available, the degree of accuracy desired, and the educational level and intelligence of the patient.

Connected discourse is useful for determining a simple threshold of intelligibility, the threshold at which either some words are first understood or the sense of the material can first be followed without effort. The same material is also useful for tests of tolerance. Either recorded speech or live voice may be used, but it is important that the intensity level be carefully monitored and that the style, difficulty, and interest of the material be uniform. Passages from Adam Smith's "The Wealth of Nations" are particularly suitable for this purpose when used with patients of moderate intelligence or better. The style is free and easy, the vocabulary is not too difficult, and the interest is low and remarkably uniform. Duller patients, however, do not have the alertness to respond adequately to this material.

In very difficult cases conversational material may be presented (by live voice) and the intelligibility judged by the appropriateness of the answers to questions. This procedure may be necessary if there is doubt as to whether the threshold of easy intelligibility is really attained at any level.

The threshold of sentence intelligibility may be determined by using the lists prepared by the Bell Telephone Laboratories* or by the Psycho-Acoustic Laboratory.† These lists are suitable for well-informed patients. Similar lists using simpler material appropriate for average military personnel have been developed at the various Aural Rehabilitation Centers. The sentences in Auditory Test No. 12,† prepared by the Psycho-Acoustic Laboratory, are also very useful. They are constructed as questions which may be answered by a single word, and are recorded in groups of three or four at progressively lower intensities. The correctness of the subject's answers gives a clear indication of the level at which he understands half of the sentences. "Sentence intelligibility" is not quite the same as "the threshold of intelligibility" for connected discourse, but in comparative tests, such as the selection of the most effective hearing aid, the nature of the threshold selected and its absolute level are of little consequence as long as they are constant throughout the comparison. It is also important that the same talker (or recorded test) be used throughout, for the threshold levels will vary from one talker to another, depending on differences in pronunciation, inflection, or quality of voice, even though all talkers monitor their voices carefully to the same level. A serious difficulty with sentence tests is that the subjects rapidly become familiar with the material. It is not safe to employ the same sentence more than once with a given subject.

The threshold of intelligibility for words is conveniently and accurately measured by two-digit numbers as recorded in the Western Electric 4C test for group audiometry, or by the two-syllable words employed in Auditory Tests Nos. 9 and

*Fletcher, H., and Steinberg J. C.: Articulation Testing Methods. Bell Sys. Tech. Jour. 8, 1929, 806, 854, and Suppl. to Jan., 1930, Jour. Acous. Soc. Am., 1-97.

†Psycho-Acoustic Laboratory report, "Recorded Auditory Tests for Thresholds of Words and Sentences," in preparation.

14.* The words in the latter tests, like the two-digit numbers of the 4C audiometer, are all dissyllables of the spondee stress pattern, *i.e.*, with equal stress on both syllables, as in "railroad" and "blackboard." In Test No. 9, developed as a write-down test for use with groups of subjects, the words are recorded in groups of six at successively lower intensity levels. In this feature it resembles the WE 4C test. Auditory Test No. 14 employs the same word lists as Auditory Test No. 9, but the time intervals between words are only three seconds, and all words are recorded at the same level. It is intended that the subject repeat the words aloud, and that the tester vary the intensity by means of an attenuator. This test is particularly adapted for rapid work with individual subjects. The same word lists can also be presented by live voice if the talker monitors his voice accurately.

The reliability of the threshold values obtained with these tests is within 2 or 3 db. when determined with recorded material, and an experienced talker may achieve nearly the same reliability with live voice. The choice among the various threshold tests will be dictated by considerations of speed and convenience, and of the level of education and intelligence of the patient.

Measurement of maximum articulation scores requires the use of word lists in which the items vary in difficulty but are grouped so that the average overall difficulty of the various lists is the same. The PB (phonetically balanced) lists* are probably the most satisfactory word lists of this type available at present. Each list contains fifty words, but it is intended that at least two such lists be used in each test if a reasonable degree of reliability is desired.

The PB lists are composed of monosyllabic words in reasonably common usage, and probably satisfy the criteria of

1. Equal average difficulty from list to list,

2. Equal range of difficulty within each list,

*Psycho-Acoustic Laboratory report, "Recorded Auditory Tests for Thresholds of Words and Sentences," in preparation.

3. Equal phonetic composition within each list, and
4. A composition as representative of all English speech as can be achieved with 50 words.

A still more difficult type of material, which may be particularly effective in detecting differences in the performance of instruments worn by patients with high-tone hearing loss, consists of monosyllables that differ from one another only with respect to initial and final consonants. The vowel employed is usually the short "i" as in "this," "fill," "dish," etc. The fricative sounds, the constant vowel, and the easily confused stops are difficult for hard-of-hearing patients, and such a list would be deliberately loaded with such consonants.

The most difficult form of test material consists of nonsense syllables, but this material is not appropriate for use in the selection of hearing aids because it is too difficult for an untrained listener to write down or even to repeat accurately the meaningless syllables that he hears.

In general the monosyllabic words grouped in the PB lists are probably the most satisfactory material with which to determine a patient's maximum articulation score. The basic limitation of this form of test is the rather low reliability of the scores with an untrained listener even when the technique of presentation is carefuly standardized. It has already been pointed out that differences of less than 5 per cent between two 50-word lists are rarely significant.

The "learning curve" or practice effect is real but brief with word articulation tests, but the same lists may be used repeatedly with the same subject if the order of the words is varied.

Performance in Noise.

Various aspects of the performance of a hearing aid in the presence of noise have been suggested for use in the selection of hearing aids. Almost all of the proposed tests are theoretically valid, but few of them have been shown to distinguish significantly among present-day instruments as worn by hard-of-hearing subjects.

Relative annoyance produced by a standard noise is the basis of one type of comparison. A type of noise that can be readily and accurately reproduced, such as "white noise," is desirable. "Static" has also been tried. Patients frequently volunteer the statement that one instrument seems noisier than another in ordinary use, and the test consists of a direct comparison under controlled conditions. Speech is sometimes combined with the noise, as in the "signal-to-noise" test, but the judgment is based on the annoyance of the noise, not the intelligibility of the speech. The difficulty with this sort of test is not so much that of producing a standard noise but that the test is purely comparative and cannot readily be scored on a quantitative scale.

It should be recognized that an instrument which provides considerable acoustic gain and which protects the listener from discomfort or pain by a properly limited maximum output is likely to sound "noisy." This impression is correct because both the speech and the background noise are amplified by the hearing aid. The speech, which (to be intelligible) must be louder than the background noise, is limited before the weaker noise of the background, and its margin of predominance over the noise, therefore, becomes reduced. This is not a fault of the instrument but is a necessary consequence of the necessary protective action of a hearing aid. All contemporary hearing aids with high acoustic gain are fundamentally alike in this respect.

The signal-to-noise ("S/N") ratio at which speech becomes intelligible can be determined easily and is a good, theoretically sound, basis for distinction between instruments provided any significant differences can be demonstrated. Continuous discourse or dissyllabic words can be presented at a constant level and the intensity of noise which brings the speech just to the threshold of intelligibility can be measured and the signal-to-noise ratio calculated. Patients differ widely in the signal-to-noise ratio that they require for intelligibility. Most of them have much more difficulty than do normal listeners in discriminating words in the presence of noise, but it is not often that hearing aids differ greatly from one

another in their ability to assist a patient in understanding speech in the presence of a standardized noise.

Noise may be combined with articulation tests in order to make the latter more discriminating if the patient is able to attain too high a maximum score on the PB lists. Differences between instruments are more likely to be revealed by maximum articulation scores if the scores are not too high, say between 50 and 80 per cent. The introduction of a standardized amount of noise is one way of increasing the difficulty and, therefore, the discriminating power of the articulation test. It is important, however, to standardize the character of the noise and the signal-to-noise ratio. This procedure has been used extensively in experimentation at the Psycho-Acoustic Laboratory but has not been tested in clinical practice.

In evaluating the usefulness and appropriateness of selective tests based on the use of noise it must be recognized that an arbitrary element is introduced in the specification of what kind of noise is to be employed. It is essential to specify the standardized noise quantitatively and some arbitrary specification is therefore unavoidable.

Composite Programs.

Various selective tests, from audiogram fitting to signal-to-noise ratio, have been described. A few seem to be theoretically sound and also practical, but all have definite limitations. *No single test solves the problem of prescribing hearing aids.*

In fairness to the Aural Rehabilitation Services of the Army and Navy, who are engaged in selecting hearing aids for military personnel and are employing some of the tests that we have criticized, we do not wish the tenor of our comments to be misunderstood. Nearly every test employed is valid within certain limits. The limitations of some of the tests are now more clearly understood than they were at the time the procedures at the various Rehabilitation Centers were standardized. Furthermore, each Aural Rehabilitation Service has employed not merely a single selective test but a battery of tests, and such a group of tests, combined with a

program of auditory training, is far stronger than any one test taken alone. It has been clearly recognized at the clinical level that no one test is sufficient and that choice should be based on "the picture as a whole." "Experience and clinical judgment" are used in weighting and combining the results of the various tests. It is not so clearly recognized that the use of "experience and judgment" instead of clearly formulated rules contradicts to a large extent the "scientific objective value" sometimes claimed for the tests that are employed. The situation has not been serious, however, since at worst the tests have usually been merely inconclusive and have led to a false idea of precision rather than to any demonstrably ill-advised fittings. Choices of instruments might have been different and perhaps made more expeditiously by other routines, but any one of several choices of instruments would probably have been equally good.

It is not within our competence to comment on the relative merits of the "Deshon plan" or the "Borden plan" or other plans as a whole. We may note as a point of fact that the psychological approach in the two above-mentioned plans differs quite clearly. In the Deshon plan several instruments are selected by "objective preselection tests" but the final choice of a hearing aid is deferred until after the patient has tried each of them in a variety of situations over a period of days. The patient's preferences are considered as well as the results of the final objective tests in making the final choice. It is believed that the wider experience with a variety of instruments and the participation of the patient in making the choice gives the patient great confidence in the correctness of the final choice. In the Borden plan the choice of hearing aid is made by the staff, on the basis of audiograms and objective tests, as early in the procedure as possible. It is believed that such an early and firm decision also gives the patient great confidence in the correctness of the final choice and that he then wholeheartedly devotes himself to learning to make the best use of the instrument.

The two plans both recognize the importance of confidence of the patient in the tester, in the method of testing and in

the correctness of the final choice. We agree fully in the desirability of such confidence; and we believe that one of the benefits of "objective testing" of hearing aids, and of talk of "selective amplification" and of a "scientific basis of fitting," has been exactly this psychological benefit of confidence of the patient, based in turn on the self-assurance of the tester. It is interesting to note, however, the two very different approaches by which the confidence of the patient has been attained in the past; and there would seem to be no reason to fear that frank recognition of the limitations of current procedures will make it impossible to engender the same confidence in the future.

VI – SUMMARY OF PRACTICAL SUGGESTIONS.

Many special requirements and limitations may determine the form and the scope of a plan for the selection of hearing aids. We shall present our practical suggestions in the form of an imaginary routine, which can be adapted, in whole or in part, according to the availability of equipment and the judgment of the tester to suit an actual situation.

Three general principles should be observed for the formulation of a testing routine:

1. *Simplify the objective tests.* Design them to insure adequacy in essentials rather than to try to discover a uniqueness of fit that rarely if ever exists.

2. Design the tests and the routine to *discover any special problem or unusual feature* of a case that may require special or unusual procedures.

3. Keep clear in mind the *medical and psychological aspects of the problem,* including the indoctrination and training of the patient.

Preliminary Screening of Instruments.

The reports of the Council on Physical Medicine of the American Medical Association furnish information as to engineering characteristics and the acoustic performance of many hearing aids. Unfortunately, the list is not complete, and additional new models appear month by month. Whoever undertakes to prescribe hearing aids must supplement those

reports by his own personal experience and judgment of instruments. Economic considerations may also limit the field of instruments to be considered, but some "engineering screen" is a matter of obvious common sense. Certain desirable features of design, such as the adjustable tone control, as well as ruggedness, reliability, etc., may be made the requisites for admission of instruments to further consideration. In short, personal experience must supplement the preliminary "engineering screens."

The desirable specifications and characteristics of a hearing aid have been outlined in Chapter IV. *A problem as yet unsolved, however, is how to determine objectively which instruments come closest to meeting them.* It is also unknown just how much deviation from the ideal may be permissible before performance is significantly impaired. The problem of satisfactory "engineering screening" on an objective basis is difficult, and it must be solved by each Hearing-Aid Center according to the best judgment of the responsible individuals.

Medical and Audiometric Examination of the Patient.

It is assumed that thorough and competent medical and otological examination of the patient has been made before a hearing aid is recommended or selected. *A clear prognosis* as to possible increase of the patient's hearing loss is an important part of his psychological orientation toward the use of a hearing aid, and also toward auxiliary measures such as auditory training and lip reading. Medical considerations may also aid in the decision of whether the ear will be benefited by a hearing aid and whether a bone-conduction or air-conduction receiver should be used.

Further medical details are out of place here, and we also forego discussion of the difficult but important psychological (or psychiatric) problems of *malingering and of true "functional" deafness* of an hysterical sort that may be combined with the more usual types of hearing loss that are caused by irreversible pathological changes.

Careful *audiometry* should be included among the preliminary tests. We minimize the importance of the audiogram as

a guide to the selection of a hearing aid, but this does not detract in the slightest from the medical value of audiometry for diagnosis, for prognosis, and for providing an objective record of the status of a patient's hearing. We believe that it is desirable to measure also, if the proper instrumentation is available, the patient's hearing loss for speech as well as his loss for pure tones. The loss for speech and the audiogram are very useful in determining whether to prescribe a hearing aid and which ear to fit, but we shall not consider these clinical problems further.

The Individually Molded Earpiece.

It is a problem for each tester to decide whether to defer the first trial of a hearing aid by a patient until after his individually molded earpiece has been made. The manufacture of the earpiece is a specialized technical procedure. We merely emphasize the desirability of a good but comfortable fit. A close fit, providing a real acoustic seal, is essential if a high-powered hearing aid is to be used.

A good molded earpiece must be provided at some stage of the fitting process. Indoctrination, training and practice can often be carried out more or less satisfactorily with "universal" earpieces. The point is that no *final* tests or selection can properly be made without a well-fitting individual earpiece.

Preliminary Selection of Instruments.

Preliminary selection of the instruments and earphones to be tried should be based on an effort to provide a combination with good acoustic fidelity and the appropriate level of maximum acoustic power. The frequency characteristic sought is one that is uniform (free from sharp peaks), and either "flat" in its general trend or giving a moderate suppression of low tones. The details of the desired frequency characteristic have been given in a previous chapter. We emphasize again, however, that *this selection is based purely on the physical, electro-acoustic characteristics* of the instruments, and can and should be *determined in advance* as objectively as possible and *without regard to the patient's individual audiogram.* Certain models can be recognized as good, others as less desir-

able, for all or nearly all patients. At this point, however, if cost is a consideration, excellence of acoustic properties may be balanced against expense in choosing the instruments which the patient will try.

The severity of the patient's hearing loss, as indicated by his audiogram and by his hearing loss for speech, will indicate the probable desirability for him of an instrument of high maximum acoustic output. Of course, the tolerability of such an instrument must be determined later by direct test; but if a patient's hearing loss is only moderate it is unnecessary to recommend for him the probably more expensive and possibly uncomfortable high-powered instrument.

Indoctrination and Practice.

The details of procedure in the first demonstration of a hearing aid to a patient do not lie within the scope of this report, nor does his indoctrination in the use of the instrument. It is obviously important, however, that the patient be taught the care and the correct use of a hearing aid.

There is an initial period of learning when the patient's ability to understand speech with a hearing aid may increase considerably and rather rapidly. Opinion differs as to whether or not a long period of indoctrination and training should precede the final selection of an instrument. Most of the arguments, pro and con, rest upon the assumption that there is an important individual relationship between the patient and his instrument. Some emphasize the importance of a variety of experience by the patient with several different instruments so that his preferences may be used as a guide in final selection, and so that initial learning effects are over and quantitative differential tests are more accurate. Other arguments stress the desirability of training the patient to learn to interpret speech as heard with one instrument, selected early (and authoritatively), and of not confusing him during training with instruments of different acoustic properties. We believe, however, that the differences between the better instruments are relatively slight, and the chief purpose of an indoctrination period is to demonstrate to the patient the

nature of a hearing aid, the use of its controls, and its limitations, and to accustom the patient, who may have been hard of hearing for some time, to listening once more to reasonably loud sounds.

We suggest that the first indoctrination period be employed for preliminary selection of the more promising instruments. This may be done by providing some standard speech, either sentences or connected discourse, at controlled intensity levels. Live voice, if monitored, may suffice, but speech recorded on a wire recorder and amplified as desired has proved extremely useful for this preliminary stage of trial and indoctrination. The tester's objective at this point is to determine whether good intelligibility is attained by the use of a hearing aid, and also whether there is any unusual sensitivity of the patient to loud sounds. The choice of the most appropriate test material for the next tests will be determined by his responses during the indoctrination period, and it should be possible to reject any obviously inadequate or unacceptable instruments and to detect at this stage any unusual difficulty or handicap that may require special consideration in subsequent tests.

Objective Screening: Sensitivity and Operating Range.

The tests for sensitivity and tolerance are listed as screens rather than as selective or "fitting" tests because it is anticipated that most of the instruments tried will prove adequate for most patients. These tests are objective and quantitative, and for patients who are severely hard of hearing or who are intolerant of loud sounds they serve as critical comparative tests.

The equipment required includes a reasonably quiet, sound-treated room and an amplifier-loudspeaker system of good fidelity that will deliver speech at any desired level from 30 to 100 db. above .0002 dyne/cm.^{2} The material may be recorded or it may be monitored live voice, as desired. Connected discourse is appropriate for rapid work with intelligent patients who can be trusted to report the threshold of intelligibility directly. For more precise end-points and for less intel-

ligent patients the spondaic words of Auditory Tests Nos. 9 and 14 are recommended.

The conduct of the test has been outlined in a previous chapter. It is optional with the tester whether the instruments should be worn by the patient in the usual position or whether they should be mounted on a standard acoustic baffle. The tester determines:

1. Whether the patient can, with *any* setting of gain control, understand connected discourse (or spondaic words) delivered at normal conversational level (60 to 70 db. SPL). If the patient cannot obtain good intelligibility with any of the instruments tried, he becomes a candidate for a special intelligibility test, to be described below.

2. Whether the patient can understand conversational speech (or spondaic words) at a standard low level, such as 40 db. SPL or 20 db. above the normal threshold of intelligibility. If so, the instrument has adequate sensitivity. If not, the threshold for speech is measured, using maximum gain-control setting. The use of maximum gain-control setting constitutes a valuable incidental test for possible acoustic feedback due to imperfect fit of the individual earpiece.

3. Whether the patient can, with the same gain-control setting, tolerate for a few moments continuous speech delivered at a standard high level of 100 db. SPL, *i.e.*, 60 db. above the standard low level. (As previously noted, this part of the test must be conducted cautiously and only after full explanation to the patient. It should not, however, cause discomfort if the instruments for the first tests are conservatively selected to have only a low or medium maximum acoustic output). If the high-level speech is *tolerable* it is then determined whether it is also *intelligible.* If it is not tolerable, an instrument of lower maximum acoustic output must be found, or the patient given a special course of graded "acoustic massage" to increase his tolerance. Special problems of tolerance should easily be detected here.

At this point an instrument is considered adequate if, with a given volume-control setting, it allows an operating range of

60 db. of input levels over which speech is tolerable and intelligible. If the operating range is less than 60 db., differences in operating range may be used as a critical test to discriminate between instruments. A slightly less rigorous criterion is an operating range of intelligibility of only 40 db. (from the standard low level of 40 db. SPL to 80 db. SPL), but *tolerance* for 100 db. SPL should be sought even if the very loud speech is no longer *intelligible.* The standard high level may be determined in practice by the output of the test equipment available, but should not be less than 80 db.

The test of tolerance and operating range should reveal any special problems of tolerance, of requirements for very high gain and high acoustic output, and of failure to obtain satisfactory intelligibility.

Optional and Special Tests: Tolerance, Articulation and Signal-to-Noise Ratio.

It should be noted that the test of tolerability that enters into the determination of operating range is not an adequate or final test of the optimum power output for the patient unless it is conducted with several instruments of different maximum outputs. No additional test is necessary if a standard or low-powered instrument gives fully adequate performance, and if the additional power would involve additional expense or battery weight. If, however, the patient is very hard of hearing and the performance of standard instruments is not entirely satisfactory, it should be remembered that the widest operating range and the least distortion of speech at high output levels is obtained if the level of maximum acoustic output is set as high as possible within the patient's limit of tolerance.

A final test for choice of maximum acoustic output does not differ in technique from the test of tolerance already described. Instruments are systematically compared with respect to tolerance at maximum output. An important practical qualification is, however, that *this test should not be conducted until after the patient has had considerable experience in the use of a hearing aid or has been systematically exposed to loud sounds near his threshold of discomfort. And*

the psychological aspects of all tests of tolerance must be handled with care.

If the patient has difficulty in understanding speech with a hearing aid, or if he is not satisfied with its "quality," it is desirable to conduct an *articulation test* to determine the maximum score that he can obtain with the instrument. As previously explained, the input level and the gain of the instrument should both be high so that a true maximum score will be obtained. The PB lists of monosyllables are the most appropriate material available, although special lists of more difficult material may be substituted if they have been adequately standardized. Either recorded material or live voice may be employed. If a patient's maximum articulation score is below 50 per cent on the PB lists, this test becomes very important and may be critical. If, however, the patient merely complains of the "quality" of speech, the results will not often show significant differences. They may be very useful to demonstrate to a patient that he can understand speech better with an instrument whose quality is (at first) less pleasing to him. A test of this sort repeated at intervals may also be valuable to assess the progress made by a patient in the course of his auditory training.

A final special test is the *performance of instruments in the presence of noise.* Words, preferably the spondaic words of Auditory Test No. 14, are delivered at constant level and some type of standard noise ("white" or "static" according to the choice of the tester or the instruments available) is increased until the patient's threshold is reached. The distinction between instruments is based on the signal-to-noise ratios at which the threshold of intelligibility is reached. This test also is not likely to discriminate objectively between instruments, but it is useful if a patient complains of inability to discriminate voices readily in mixed conversation or in noisy surroundings. It may also help him to make subjective judgments of preference (if such judgments are desired) or to learn which setting of the tone control he prefers to use in the presence of noise. The test may be usefully instructive even if it does not discriminate objectively.

The optional tests of tolerance, of maximum articulation score, of signal-to-noise ratio, and perhaps also of subjective quality preference, have a place in the selection of instruments for the more difficult or unusual cases. They should be employed at the discretion of the tester, but they are not all necessary as part of a general routine for every patient. The effort should be made to *simplify the routine testing* and to use these special tests only for difficult cases where they are specially indicated. *The guiding principles are to determine the factors which limit the performance of each patient, to recognize and study carefully the difficult and unusual cases, and to advise the patient to consider carefully the necessary compromises that frequently must be made.* It is here, as in the practical knowledge of the good and bad features of different instruments, that the skill, experience, and wisdom of the tester assume their full importance.

The Future Development of Selective Testing and Auditory Training.

We may anticipate that, as hearing aids are improved and approach more and more closely the design objectives outlined in an earlier chapter, the problems of objective selection will become simpler. It now seems probable that a single frequency characteristic can be provided which, when supplemented by an effective tone control, will give the best results with almost all patients regardless of the details of their hearing losses. *Objective selection will then be reduced simply to a tolerance test to determine the appropriate maximum acoustic output.* The audiogram and the measure of loss for speech will provide useful guides for estimating an appropriate value for this maximum output. A final objective test will usually be desirable, but only after the patient has been given a period of indoctrination and auditory training. The choices among instruments will become more and more matters of mechanical detail, of size, of weight, of ruggedness, or of expense. Expert advice on these matters will still be of great value to the patient, and some means (if it can be developed) of assuring the uniformity of the product of each

manufacturer will obviously be of great assistance to the adviser.

Although the selection among instruments will become less and less critical as all of them approach the inherent limitations of possible electro-acoustic performance, the problem of training the individual patient will remain. To many patients, it will be impossible, unfortunately, to restore full or even satisfactory auditory function by any type of instrumental assistance. In every case, furthermore, the patient can improve his performance by practice, and he can be assisted greatly in this improvement by well planned and well conducted training in the use of his hearing aid and in the interpretation of the sounds that he hears. The details and even the principles of such auditory training, and the whole field of lip reading as an aid to impaired auditory function, lie beyond the scope of this report. We wish, however, to acknowledge and to emphasize their importance equally with the importance of proper evaluation and handling of the medical and the psychological factors in the case of every patient.

The problem of the future is twofold: *the engineering problem of constructing an improved hearing aid according to known design objectives, and the psychological problem of teaching the patient how to make the best use of his remaining faculties with the assistance of his hearing aid.* The problem of the selection of a hearing aid may still call for expert advice on technical details, but it is likely to turn less on acoustic and more on economic factors as the various manufacturers converge on similar design objectives.

AMERICAN BOARD OF OTOLARYNGOLOGY.

The next examination of the American Board of Otolaryngology will be held in Chicago at the Palmer House from May 22 to 25.

THE ROLE OF SINUSITIS IN EYE PATHOLOGY.*

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Nashville, Tenn.

In presenting a paper along this line I am running true to form. In looking back over my long professional life, I find that I have always been interested in the phenomena of focal infection. When a member of the house staff of the Manhattan Eye and Ear Hospital from 1896 to 1899, I was fascinated by the spectacular way phlyctenular ulcers cleared up after a well executed tonsillectomy and adenectomy. In the house staff a technique of tonsillectomy was developed with the McKenzie tonsillotome that gave a clean tonsillectomy on practically all children. About 1910, I figured that if iritis was caused by rheumatism and rheumatism was caused by infected tonsils, why would not the removal of infected tonsils help acute and recurrent iritis? I removed the tonsils in a case of acute iritis and was amazed to find the iritis practically gone the next day. In 1917, I presented case reports of 12 acute and recurrent cases of iritis before the Southern Medical Association under the title of "Surgery as a Therapeutic Agent in Acute and Recurrent Iritis." In 1920, I delivered, by invitation, an address before the District of Columbia Society of Ophthalmology and Otolaryngology under the title of "Eye Disease as an Index to Pathological Conditions Within the Body," published in the *Eye, Ear, Nose and Throat Monthly*, August, 1925. I presented a paper before the Eye, Ear, Nose and Throat Section of the Southern Medical Association at Oklahoma City, November, 1938, entitled, "The Effect of Sinus Disease on the Eye," in which I presented four remarkable cases of restoration of vision after operation on the sinuses. Two cases had been diagnosed as atrophy of the optic nerve. The series I am reporting were very interesting to me. I have had more of these cases but have selected 12 which, I think, illustrate the type of eye pathology found in connection with chronic purulent sinusitis.

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*Read at the meeting of the Southern Section of the American Laryngological, Rhinological and Otological Society, Inc., Richmond Va., Jan. 7, 1946.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, March 5, 1946.

Since the cornea has no blood supply of its own, it seems natural that it should be the first to be affected by a toxic condition in other parts of the body.

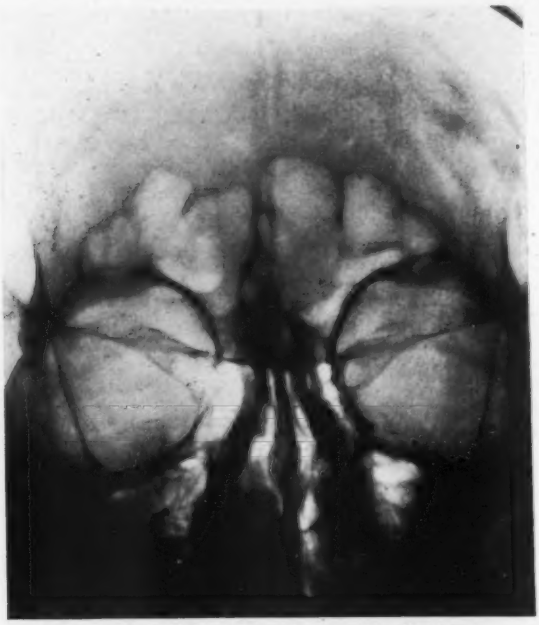
Case 1: On Jan. 8, 1944, D. L., age 16, was referred to me by Dr. William E. Sauer, of St. Louis. The patient found that he was gradually losing the vision of his right eye. His father took him to Dr. Martin H. Post, of St. Louis, who diagnosed central retinochoroiditis. In an effort to find a cause, Dr. Post asked Dr. Sauer to examine the sinuses. The sinuses were X-rayed by Dr. Edwin C. Ernst, who reported that both maxillary sinuses were very cloudy. As the boy was attending Columbia Military Academy, Dr. Sauer referred the patient to me.

A test of the patient's vision showed 20/200 in right eye, obtained by turning the head to one side. The fundus examination showed central retinochoroiditis with a pigmented exudate. The antra showed densely cloudy under transillumination. I asked Dr. Sauer for the films. After looking at them, I called the boy's father at his home in Illinois and asked him to come to my office. I told him that I saw no reason to believe that any treatment offered a hope of saving the boy's sight except draining the antra. He agreed and the boy was placed in the Vanderbilt Hospital. I did a radical Caldwell-Luc operation on both antra, Jan. 22, and found both filled with pus and polypi. There was a severe reaction, and the boy ran a temperature of 104° for five days, decreased under sulfathiazole. He remained in the hospital for 10 days and then returned to school. He came back to my office in a week and the first thing he said was, "Doctor, I can see better out of that eye." I thought it might be wishful thinking, so I did not test the vision for fear of discouraging him. He came back the next Saturday and said, "Doctor, I tell you I can see better out of that eye." I tested him and found he had 20/70 vision. Each Saturday the vision was better, and before the close of school it had reached 20/20. It was most interesting to watch the change in the fundus picture. The pigmented exudate regenerated from the edges toward the center until there was nothing left but a scar below the macula where the inflammation had destroyed both retina and choroid.

He had confided to me when he first came that it was his ambition to join the Navy. At the time I thought it was an impossibility. He wrote me that he had been called by the Navy, and then came the triumphant letter, "I have passed the Navy test of my vision and I am in the Navy." You all know how rigid the Navy test of vision is. Not the least of the benefits was the great improvement in the boy's health and morale. He gained weight, color and vigor.

Case 2: July 27, 1945, C. D. W., aged 54, consulted me for recurrent ulceration of the left cornea. He had suffered for several years and lost a great deal of time from his work. He had been under almost continuous treatment all that time. The ulceration would clear and then recur. He caught cold very easily. An X-ray by Dr. Shoulders showed both antra cloudy. He readily agreed to an operation. I did a radical operation on both antra, Aug. 2, 1945, at St. Thomas' Hospital. He was in a weakened condition, and his circulation went bad under the anesthetic and gave us considerable anxiety; however, I finished the operation. The ulceration of the cornea cleared up while he was in the hospital. He had a rather severe reaction and stayed more than a week in the hospital. The improvement in his health was almost as remarkable as the im-

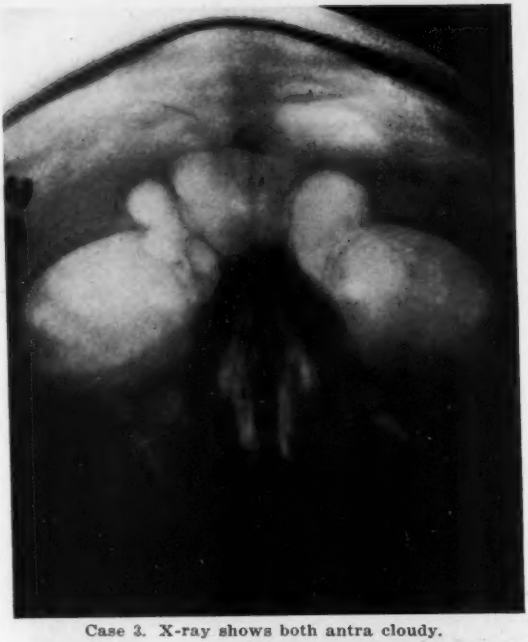
provement in his vision. I fitted him with glasses which gave him 20/15 vision. He gained more than 20 pounds in two months, and there has been no recurrence of the ulceration.



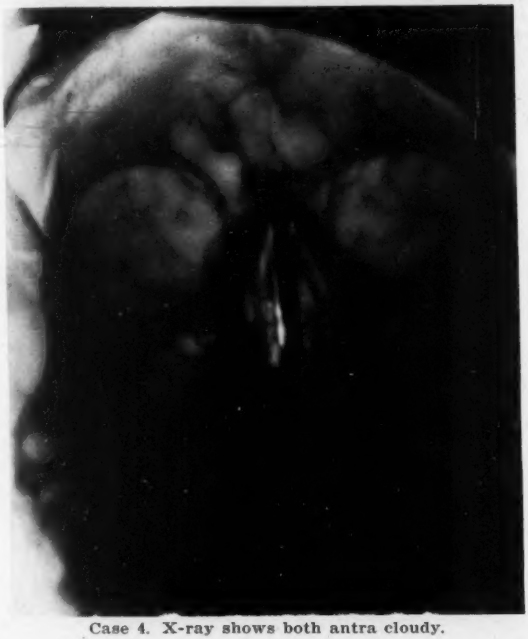
Case 2. X-ray shows both antra cloudy.

Case 3: R. B. C., aged 49, consulted me on Jan. 23, 1945, for an ulcer on his right cornea. This was an old story with him. He had had many attacks which had incapacitated him for months at a time. The eye was practically sightless, being ambyopic from a strong internal squint as well as from the opocities. I gave him the usual treatment of cauterization, atropine, zinc drops and heat. It would clear up for a few weeks and then break down again. An X-ray of his sinuses, June 5, 1945, showed practically all sinuses cloudy. He was a very busy road contractor and would not listen to a suggestion of operation. He finally consented to let me remove a pair of badly infected tonsils. This was followed by marked relief for some time; but later he had an acute flare up of his sinuses and the ulcer broke down again. He then agreed to have a radical operation on both antra, which I did at St. Thomas' Hospital, June 5, 1945. Both antra were badly diseased. The ulcer cleared up while he was in the hospital and now after six months there has been no recurrence.

Case 4: Mrs. W. D., aged 20, was referred to me by a man whom I consider the equal of any eye man in the world. The reason he sent her

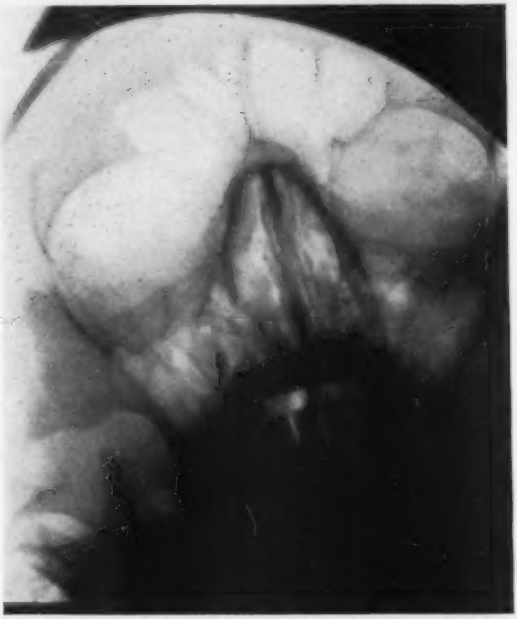


Case 3. X-ray shows both antra cloudy.



Case 4. X-ray shows both antra cloudy.

was because she had moved out of his jurisdiction into mine. She had been under his care for a long time for ulceration of the right cornea and iritis. She consulted me, July 13, 1939. There were a number of opacities involving the pupillary space in the right eye. The conjunctiva was much inflamed and there was marked ciliary infection. The left eye was inflamed and there was infection. The condition was diagnosed by the oculist as tubercular. She was placed in the hands of an internist, who X-rayed the chest and after exhaustive examination reported that he could find no trace of tuberculosis. She had diseased tonsils and both antra were cloudy under transillumination. She agreed to a tonsillectomy but objected to a sinus operation. The tonsils were removed on July 15. Instead of improvement, the eye was worse. An X-ray of the sinuses on July 26 showed both antra cloudy, with evidence of polypi in both antra. On July 28, I did a radical Caldwell-Luc on both antra, and pus and polypi were found. There was marked improvement of the right eye, and the left eye, which likewise was becoming involved, cleared up. I was able to fit the left eye with glasses. A +1.25 cylinder axis 75° gave 20/15 vision. She left town one week later. A letter several months later said the right eye remained quiet and the left eye was perfect.

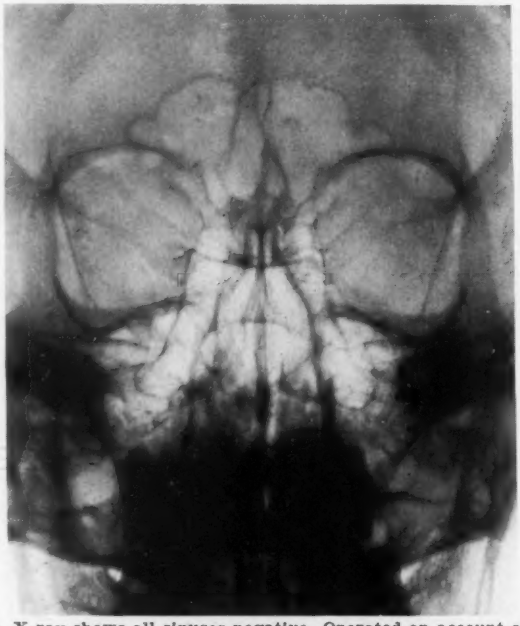


Case 5. X-ray shows both right antrum and right ethmoid very cloudy. Left antrum cloudy.

Case 5: Miss M. A., aged 23, a school teacher, consulted me on Feb. 8, 1941. She suffered constant headaches, and was unable to carry on work

because reading was so painful. Inspection showed middle turbinate making pressure against septum. X-ray showed right antrum definitely cloudy. Fitted with glasses —0.50 sphere —0.50 cylinder axis at 90° over each eye. She wore these with some relief for two years, but the headaches continued. In August, 1943, she accepted my advice to have a radical operation on right antrum and simple operation on left. May 5, 1944, I did an exenteration of the right ethmoid labyrinth, which was filled with pus and polypi. The headaches were completely relieved and she was able to use her eyes with comfort.

Case 6: Mrs. W. M. B., aged 38 years, consulted me Sept. 26, 1944. She had to give up her work because she couldn't see to read. An examina-

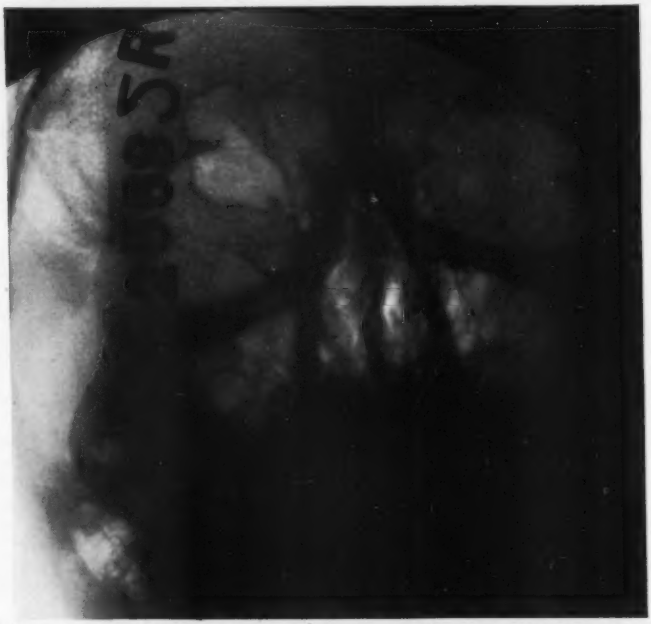


Case 6. X-ray shows all sinuses negative. Operated on account of clinical symptoms. At operation both antra found completely filled with pus and polypi.

tion showed she only had 20/40 vision in each eye. Lenses did not improve her vision, nor did they enable her to read. This was very much like toxic amblyopia. She told me that all her life she had had trouble with her nose. Transillumination indicated cloudy maxillary sinuses. I was much surprised when an X-ray came back absolutely negative for all sinuses. She was in very poor health. She had consulted many physicians and as a result she had had her appendix, ovaries and uterus removed. I had had bad sinus cases returned with a negative X-ray report before, so I was not too impressed. Her clinical history was so

clear that I advised an operation on both maxillary sinuses. The patient was slow to accept the verdict and did not return for the operation till Dec. 18. I did a simple operation on the right antrum, and a radical Caldwell-Luc on the left side. On the strength of a negative X-ray report I was not prepared for what I found: The left antrum was absolutely filled with pus and polypi. I lifted the polypi out in masses. About a month later, I removed a pair of badly diseased tonsils. Her improvement was remarkably spectacular. She rapidly gained weight, color and vigor. With a +0.50 cylinder at 165° over the left eye, she had 20/15 vision in each eye. She returned to her work and has had no trouble of any kind. The restoration of her vision and vitality was most gratifying to me.

Case 7: E. T. H., aged 74, consulted me, July 22, 1940, account of failing vision. He had been a patient in the office since Nov. 21, 1893. My

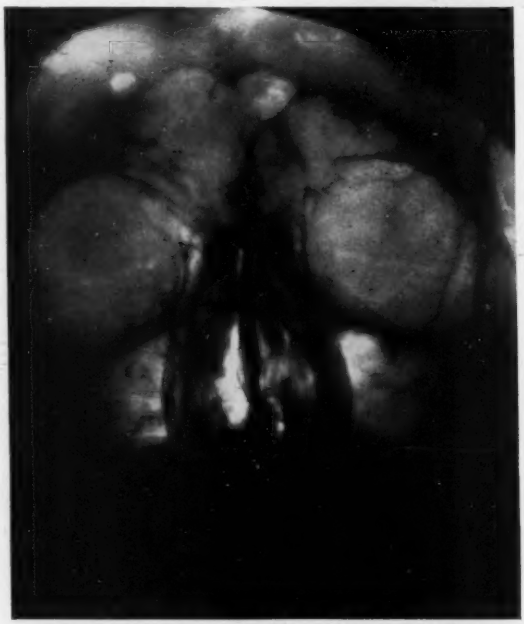


Case 7. X-ray shows all sinuses cloudy. Both antra very cloudy with polypi in both antra.

late partner, Dr. George W. Hale, fitted him with glasses on that date. He had 20/20 vision in both eyes. I fitted him June 8, 1929, and he had 20/20 right and 20/20 left. I found a central scotoma in the left eye on July 22, 1940. He had, with correction, 20/50 right, 20/70 left. His fundus now showed central retinitis, which is called retinitis circinata by the British, and retinitis senilis by Americans. There is an area of exuda-

tive white spots around the region of the macula. These patients ultimately lose central vision but the peripheral vision is generally maintained. Transillumination indicated both antra and both frontals cloudy. X-ray by Dr. Shoulders shows both frontal sinuses cloudy, both ethmoids cloudy, both antra very cloudy, with what appears to be a polyp in right antrum and a very large polyp in the left antrum. He was below par and was suffering from rheumatism. I felt that he should have his antra drained, even if he had had no fundus trouble. On Aug. 5, 1940, I did a radical Caldwell-Luc operation on both antra. They were in bad condition, containing both polypi and pus. He bore the operation well; his health began to improve rapidly; he acquired a ruddy, healthy look and became very active in his real estate business. His central vision was lost before he consulted me, but his peripheral vision improved and he was able to read, which he had not been able to do for some time. He is still living at the age of 80 and still conducts his business.

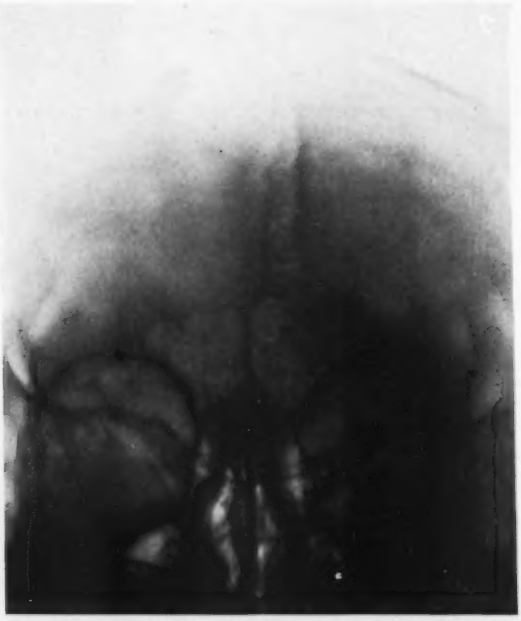
Case 8: F. A. O., aged 45, wrote me on July 13, 1941, that Dr. J. W. Barton referred to my writings on the effect of sinus disease on the eye,



Case 8. X-ray shows right antrum very cloudy.

in the Chicago Daily News. He continued, "I have lost the vision of my right eye almost completely, and the other one is impaired and is causing me similar trouble. This came about three years ago when I had a severe head cold, during which time I had a hemorrhage in the now

blind eye. I have a tendency to head colds and a catarrhal condition. In your article as Guest Editor of the Medical World, you called attention to the silent sinus infections that remain quiet but may really be the cause of other disturbances and are only in evidence when the person catches cold. Would it be possible for you to examine me and advise whether I have a sinus infection that may be the source of my eye troubles and whether you can benefit and aid my eyesight." He consulted me on July 29, 1941, and I found that his right eye had gone out as a result of a retinochoroiditis involving the macular region. He complained that his left eye gave him so much trouble that he was unable to do his work. His right antrum was cloudy under transillumination.



Case 9. X-ray shows left antrum cloudy, other sinuses clear. On account of clinical symptoms and drainage from right nostril, right antrum was also operated on and found to be almost as bad as the left antrum.

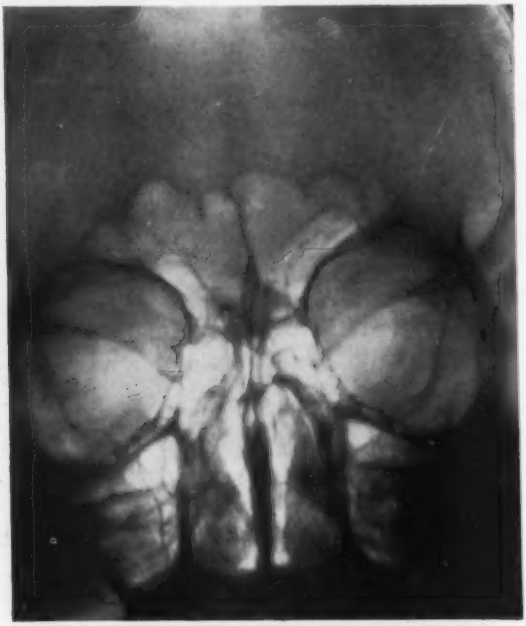
Dr. Shoulders reported all sinuses clear except the right antrum, which was very cloudy. The film disclosed a tumor mass in the right antrum, presumably a polyp. He was hospitalized and a radical Caldwell-Luc was done on the right antrum July 31. Free pus and a large polyp were found and the antrum was thoroughly cleansed. He remained in Nashville for two weeks after the operation. Before he left, I fitted his good eye with glasses. A —1.12 sphere combined with —0.37 cylinder

axis 90° gave 20/15 vision; with a +1.12 additional for reading. He wore this correction with great satisfaction for several days before he left. He went straight to work on his return and writes me a grateful letter every year. His health also was greatly improved.

Case 9: C. H., aged 11, consulted me on April 11, 1945. He gave a history of an inflammatory condition of both eyes, which had kept him out of school for three years. His lids were red and swollen, the conjunctiva of both eyes was violently inflamed and there were marginal ulcers of the cornea in both eyes. He had been taken to Dr. Likely Simpson, in Memphis, the year before, who removed his tonsils and washed out the antra. It gave him considerable relief, but when he returned home the condition recurred with increased violence. Treatment was carried out along the usual lines with varying success, but when he caught cold there would be a violent reaction in his eyes. This caused me to have an X-ray picture made of his sinuses. The report came back, all sinuses clear except the left antrum which was reported cloudy. On July 14, I did a radical Caldwell-Luc operation on the left antrum. It was nearly filled with polypi. Because there was considerable drainage from the right nostril, I did an intranasal operation on that side. The result was spectacular, and the eyes cleared up promptly; however, there was profuse purulent drainage from both antra. I irrigated them twice a week for four weeks, when the drainage stopped. He returned home and started back to school and was getting along well when he contracted a severe cold and the eyes flared up again. Irrigation through the operative openings brought out large quantities of pus. A few irrigations cleared up the drainage. He had a troublesome error of refraction which no doubt contributed to the irritation of his eyes. With a +1.0 cylinder axis at 135° over the right eye and a +0.75 cylinder axis at 45° over the left eye he had vision of 20/20 in each eye. For several months now he has had no trouble and has attended school regularly. His certainly was a most unhappy situation, and it seemed that he would never get an education. His general health has greatly improved.

Case 10: Mrs. L. O. U., aged 49, consulted me Aug. 16, 1945, for a chronic inflammatory condition of the lids of both eyes with ulceration of the corneae. This case was very similar to the previous case. She had suffered for two years and had been under constant treatment. She was under the care of an ophthalmologist for a year, when he referred her to an allergist, who treated her constantly for a year. Her family physician referred her to me. Transillumination indicated a cloudy left antrum. An X-ray by Dr. Shoulders showed the left antrum very cloudy. She also had badly diseased tonsils. A radical Caldwell-Luc operation was advised on the left antrum, with tonsillectomy to be done later. She agreed and a Caldwell-Luc radical was done on the left antrum on Aug. 25, 1945. When she went to the operating room, her appearance was truly pathetic. Her face around the eyes was fiery red and swollen, the lids were greatly swollen, the conjunctiva was fiery red and there were ulcers on the corneae. When I went to see her at the hospital the next morning, her nurse met me in the hall and said, "Doctor, you have performed a miracle on my patient. She seems to be well this morning." She did seem to be well, the ulcers were gone from the eyes, the swelling of the face and lids was gone, but there was some redness of the conjunctiva. I took the tonsils out on Aug. 30, 1945, and then, indeed, she appeared to be well. The eyes were entirely white and have remained so to date. I was able to give her 20/15 vision in each eye with R. +1.25 sphere combined with +1.75 cylinder axis 115°, L. +1.25 sphere combined with +1.75 cylinder axis 65° with 1.75 sphere for reading. It may

be that this degree of refractive error may have aggravated the irritation of her eyes.

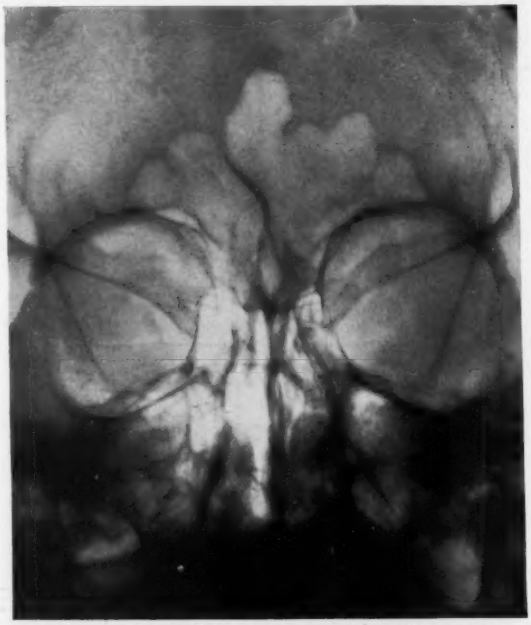


Case 10. X-ray shows left antrum very cloudy.

Case 11: Mrs. M. M., age 36, consulted me Aug. 17, 1945. The patient complained of such pain in eyes that she was unable to work. Patient has episcleritis in right eye. Patient has marked exophthalmos, and had two operations on thyroid. Is suffering from hypothyroidism and is taking thyroid extract. Examination shows left antrum cloudy under transillumination. Has a pair of badly infected tonsils. X-ray by Dr. Shoulders shows left antrum densely cloudy. Patient consented to radical operation on left antrum with tonsillectomy later. While patient was waiting for a convenient time for operation, the right eye was treated locally. I was holding the lids of right eye apart and turned my head to pick up an eye dropper. The patient and my assistant both screamed. I turned and saw the right eyeball on the outside of the lids! Perhaps I wasn't shocked and startled, too! Quickly as possible I replaced the eyeball inside the lids. I had never seen or heard of anything like this, although I have since heard of a freak in a side show who could dislocate the eyeball from the socket. This, however, shows the marked degree of exophthalmos. On Aug. 21, 1945, I did a radical Caldwell-Luc operation on left maxillary sinus. The bone of both the nasoantral wall and the anterior wall of the sinus was like ivory. I took this to mean that she had had the condition since childhood.

On breaking through the anterior wall, thick, foul pus welled out, and the cavity contained a mass of polypi.

This patient was greatly depressed, and as she was being put to bed she begged to be allowed to die.



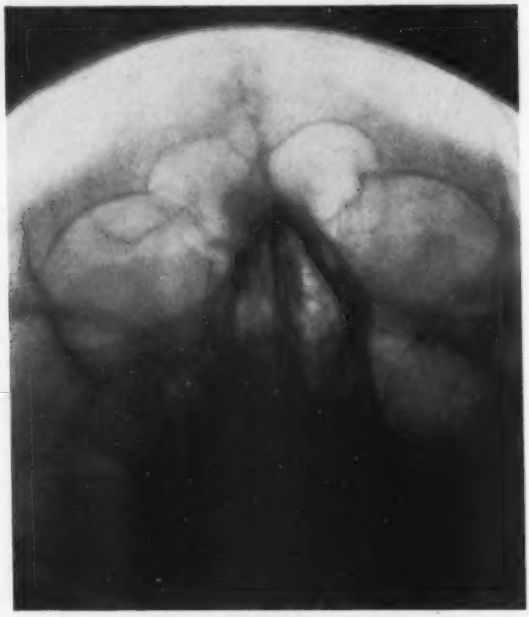
Case 11. X-ray shows left antrum densely cloudy.

On Sept. 4, I removed a pair of badly infected tonsils. When I visited her the next morning there was a great change in her mental condition; she was fairly beaming. I did not see her for another week and when she came into my office she gave me a second shock. The exophthalmos had disappeared. I have thought about this phenomenon a great deal. Could it be that exophthalmos is due to a combined toxemia of the thyroid, the sinus and tonsil, or is it possible that the sinus and the tonsils might have caused the hyperthyroid? At any rate, it seems to me that it is a strong indication for thyroid surgeons to see that all other foci of infection is cleared up.

I fitted her with +25 sphere combined with +1.25 cylinder axis 90° over each eye which gave her 20/10 vision. She was mentally bright and cheerful and took up her work with zest and enthusiasm.

Case 12: L. M., white boy, aged 15 years, consulted me on Jan. 12, 1943. He came with a letter from his local physician saying that the boy had been under constant treatment for an intractable ulcer of the left

cornea for three months without improvement. The boy had the appearance of being in poor health, had bad color, and was listless and apathetic. His left cornea had three ulcers superficially, while the substance of the cornea was opaque and strongly presented the appearance of interstitial keratitis. Vision 5/100. A Wassermann test by Vanderbilt



Case 12.

Hospital Laboratory was reported negative. An X-ray examination by Dr. Shoulders showed the right antrum very cloudy. The right antrum was drained at Vanderbilt Hospital the last of January 1943. He returned to his home in McMinnville, Tenn., for local treatment by his physician, with instructions to return monthly for observation. The ulceration gradually cleared and at the same time his health improved.

I did not see him for two years until he came back in December, 1945. The cornea was completely transparent, no sign of cornea vessels, with vision of 20/15 in both eyes. Equally gratifying to me was the fact that he developed into a tall, handsome young man in vigorous health with a keen, alert mind.

Case 13: Mrs. O. G. S., white, aged 41, consulted me March 20, 1937, for loss of vision in the left eye. Her vision had been growing worse for four years. She had traveled extensively over the United States and had consulted oculists in 23 states. There was no useful vision in the left eye. By twisting the head in different positions she could see 10.02. The vitreous humor was very cloudy. No fundus details could be made

out. Transillumination showed the left antrum very cloudy. X-ray by Dr. Shoulders showed the left antrum and left ethmoid very cloudy. At St. Thomas' Hospital the left antrum was drained and the left ethmoid was exenterated. The left antrum contained a large amount of pus and the left labyrinth was filled with pus and polypi.

When I visited her room the next morning the patient said: "Doctor, I can see with that eye." I thought it was only wishful thinking and asked her how she knew. She covered her right eye and pointed out small objects in the room. A few days later I tested her vision and it was roughly 20/20. The vitreous was still cloudy, but details of the fundus could be made out.

Two months later, I did a refraction under mydriasis and the vision was 20/15 with the details of the fundus sharp and clear. She has greatly improved in health and has regained her weight and color. I have seen her recently and her vision is normal. She is carrying on her work as a teacher.

Case 14: T. J. S., white, aged 74, was brought to me on Feb. 8, 1938, by his family physician. Dr. Harris assumed that he had cataract and brought him for operation. He was led into my office, being to all intents and purposes blind. He had lost his left eye from a perforating injury in youth. He was unable to detect hand movement, though he had perception of light. The ophthalmoscope showed no sign of cataract. The optic nerve was bluish white and the diagnosis of optic atrophy was tentatively made. There was no way to take his field except by candle projection, which was fairly accurate. There were two things against optic atrophy—the lack of contraction of the field and the fact that the pupillary reaction was normal. Transillumination showed both antra cloudy; X-ray by Dr. H. S. Shoulders showed pansinusitis on the right side and the left antrum was also cloudy. This was supported by his complaint of severe headaches. I discussed his case with him. I explained that the sinus infection might account for his loss of vision, but that it was by no means certain. I pointed out that he was 74 years old, that an operation at his age was hazardous and might not help him, but that, on the other hand, I felt that an operation offered him his only hope for improvement of his vision. After considerable discussion and some delay, both antra were drained under a local anesthetic at St. Thomas' Hospital. Both antra contained free pus, the one on the right being filled with foul pus. He reacted badly from the operation, stayed a week in the hospital, and I washed large quantities of pus from the right antrum. He returned home and was in bed quite ill for three weeks. He returned to my office in about a month. The change in him was quite noticeable. His color was much improved, he was more alert physically and mentally, and he told me that the pain in the back of his head was entirely gone. A week later, we irrigated the antra and when the assistant approached him with the white basin, he reached out and took it from her. The next time he came back he walked into the private office and sat down in the chair unassisted. At his next visit he sat in my private office and pointed out eight large and small pictures on the walls. At final visit he had 20/100 vision. He stood at the window and pointed out cars and pedestrians a quarter of a mile away. He told me very proudly that he had seen the moon clearly the night before. His health was greatly improved and his family told me he was working in his garden.

Case 15: Mrs. V. D. M., white, aged 44, consulted me in regard to her eyes on Jan. 11, 1936. She complained of pain behind the eyes and inability to read. Her vision under a mydriatic was 20/15 in each eye with +62 sphere combined with +50 cylinder axis 30° over the right and +75 sphere combined with +50 cylinder axis 150° over the left. I prescribed glasses with the proper addition for her presbyopia and expected her to be relieved of her troubles. In a few months she returned complaining still of pain behind the eye on the left side and inability to read. She said she missed whole words in her reading and had difficulty in keeping on the line. I had told her some years before that she had an infection in both maxillary sinuses and advised an operation, which she declined. I again advised operation, but she did not agree. I was unable to demonstrate any gaps in her field, but she gave the subjective symptoms. Not until November, 1937, did she agree to an operation. An X-ray by Dr. Shoulders showed the right antrum cloudy, the left antrum very cloudy with a growth almost filling it. I did an intranasal operation on the right side and a radical Caldwell-Luc in the left side, removing the polyps and curetting the membrane. In about six weeks she was able to read normally. The pain behind her eyes disappeared following the operation, and she was restored to normal health and vigor from a state of semi-invalidism. I have never seen a more grateful patient.

Case 16: J. L. L., white, aged 59, was seen July 22, 1935. Vision had been failing for six months, and was worse in the right eye. He lived in the southwest and was very fond of deer hunting. The first thing that impressed him was that he couldn't tell a buck from a doe. His sight grew gradually worse until he had to give up reading, and he recognized people with great difficulty. He lives in a large city in the southwest, where he consulted two oculists of international reputation. He consulted another oculist of wide reputation in another city. He was sent through a large medical clinic and all examinations were reported as negative. He came to my office with a written diagnosis of optic atrophy. That he had lost his color sense was shown by the fact that he told his family he was going to town to buy a blue suit. He returned, proudly displaying his blue suit, but the suit was tan. My examination confirmed the findings of other oculists except that I did not agree with the diagnosis of optic atrophy. Since I could make out no fundus changes opththalmoscopically, I suspected that the blindness was of toxic origin. Transillumination showed the right antrum very dark. An X-ray by Dr. Shoulders showed the right antrum densely cloudy. The patient was very hesitant about submitting to a radical operation on the antrum, but finally consented. Radical operation on the right antrum showed it filled with dark cheesy pus the color of molasses and the consistency of mush. It took a long time to spoon out its contents. It had the appearance of an old chronic process. The patient could recall symptoms in that side of his nose since boyhood. As he went to the southwest on account of his health, it may be that it was the original cause of his bad health. He had been a victim of rheumatism and chronic backache for a long time.

About a week after the operation, he returned to his home. His vision gradually improved. I saw him a year later and found his vision normal in every respect. He was in robust health, had gone from 145 to 180 pounds in weight, and was leading a very active business life. His rheumatism was completely relieved and the chronic pain in the back had disappeared.

COMMENT.

I have presented 16 cases for your consideration. There were six cases of intractable chronic ulceration of the cornea which healed promptly after radical operation for chronic purulent sinusitis. There were four cases of toxic amblyopia which gave evidence of permanent blindness. There were two cases of retinochoroiditis which recovered dramatically. There was one case of retinitis circinata reported. There were two other cases which I did not report but which ran a similar course. There was one case of inflammatory disease of the vitreous which recovered completely in a short time after running a course for years. There was a starting case of exophthalmos which receded after draining the antrum and removing a pair of diseased tonsils. Every single one of these cases was in poor health. They all exhibited marked symptoms of toxemia with pallor, loss of weight, strength, appetite and vitality. A number of them were relieved from rheumatism. All 16 cases regained their color, weight and vigor, and those suffering from rheumatism were relieved. To see a listless, lifeless, spiritless face with dull, hopeless eyes change to a bright, animated expression with flashing eyes, to see drooping shoulders and sunken head change to shoulders thrown back and head erect is the most prized reward of our profession.

In the beginning it took all my courage to advise a radical operation in these cases. The thing that bolstered my morale was the knowledge that these patients needed the operation even if they had no eye pathology.

700 Church Street.

FOCAL INFECTION IN THE PHARYNX.*

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Although focal infection may be a controversial subject and concepts regarding it are ever changing, there can be no question that it is a factor in the causation of pain and of pathological changes in many parts of the body. I shall not attempt to defend the above statement except to cite a few cases which in my opinion prove the point. No doubt the pendulum has swung from the concept of a few years ago, that all pains and many pathological conditions were due to a focus of infection, to the modern thought that practically nothing results from it. A statement made recently by a well known internist and author of a book on medicine, that within the past four years he has referred only two patients for tonsillectomy will reveal how far the pendulum has swung away from the former concept. Previously he had recommended tonsillectomy for the treatment of infections, arthritis, acute rheumatic fever, and various other conditions associated with pain. Failing to find relief for the symptoms by tonsillectomy, he has concluded that focal infection in the throat is not the cause of these pains. It is not my thesis to prove that infected tonsils are the cause of such pains but to show that by removing the tonsils all foci of infection in the throat are not removed. Too often it is taken for granted that when the tonsils are absent the throat is free of all foci of infection, when in reality only one of several foci has been removed. There remain the lymphoid nodules on the posterior pharynx, the lateral pharyngeal bands, the lingual tonsil, the adenoids, and lymphoid tissue and tonsil stubs in the tonsillar fossae; nevertheless, just because the tonsils have been removed, immediately the concept is formed in one's mind that all foci are forever gone from the throat. Every laryngologist knows that even though the tonsils are fully removed at the time of the operation,

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Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, March 1, 1946.

lymphoid tissue often forms again in the fossae and that this tissue is usually infected and may give the same symptoms as entire tonsils. Twenty-five years ago when I was a physician at a boys' camp I inspected the throats of the entire group and found infected tissue in the fossae of practically every one of them. These boys were all in the moderate to well-to-do group and all had had private physicians for their tonsillectomies, so that this was a good cross-index of the results of well performed tonsillectomies. All of them, however, had foci of infection still remaining in their tonsillar fossae; a large majority of them also had infected lymphoid tissue on the posterior pharynx, which in my opinion constitutes another focus of infection. If one took for granted that there was no infected tissue in the throat because the tonsils had been removed, the mistake would be practically 100 per cent; however, I have since seen many throats from which the tonsils had been completely removed, and in which there was no regrowth of tissue, nor was there any infected tissue on the posterior pharynx. In many of these cases inspection with the laryngeal mirror revealed a mass of grossly infected lingual tonsil. By gross infection I mean small white or gray spots scattered through the tissue, each spot constituting a minute encapsulated abscess or an area of infection. With the postnasal mirror or nasopharyngoscope, similar tissue was often seen in the nasopharynx of adults, and constituted just as potent a focus of infection as in other areas. Unless one looks for these tissues, the throat will be eliminated as a source of infection merely because the tonsils had been removed. One cannot judge the amount of infection a tonsil has in it from its appearance. I have seen an innocent looking tonsil harboring a dram of creamy pus, the entire tonsil being a mere shell of normal appearing lymphoid tissue. In other instances when a tonsil was removed a gush of pus would pour out from behind its capsule. This is a quinsy without local symptoms and is not too rare.

All of these conditions may exist for years with or without enlargement of the cervical glands particularly in the anterior triangle. When there is a glandular enlargement, how-

ever, one can feel reasonably sure that the tissue is sending its toxins into the system.

There is nothing new about any of the foregoing; however, it has apparently been forgotten by our medical confreres and I believe should be re-evaluated by them. They are, without question, failing to find the foci of infection which are so often present and which, when removed, would eliminate many of the symptoms for which the patient seeks relief.

Case 1: A woman, aged 50 years, in the hospital for two weeks with pain in practically all her joints, fever up to 104°, and feeling so miserable she wanted to die. All the larger joints felt hot to the touch, and tender. Salicylates gave but little relief, and examination failed to reveal any causative factor. The paranasal sinuses were clear on transillumination and by X-ray, the tonsils had been completely removed, and no tissue was seen; there was no vaginal discharge, and all other examinations made by a competent internist were negative. After two weeks the internist called in various specialists. The only positive finding was a grossly infected lingual tonsil seen only with a laryngeal mirror. This tissue was cauterized, with the actual cautery at 8 P.M., at which time the patient was suffering from pain in all her joints and with a fever of 102°. At 10 P.M. (two hours later) the patient felt so much better that she left the hospital and returned to her home. She has been up and about ever since (18 months) and, although she has come to the office for several subsequent cauteries, she stated that she came only because she was told to do so, not because she felt she needed them.

Case 2: An optometrist, male, age 52 years, with the complaint of pain in his lower back. He had "been the rounds," having had a thorough physical examination by an internist and orthopedist without any cause being found. An osteopath had manipulated him without any good effect and the pain had become so disconcerting that it interfered with his work. He came to my office for an examination of the nose and throat, and the only positive finding was a small piece of infected tissue on the posterior pharynx. This was cauterized and at once the patient excaimed, "My pain has gone!" I was sure this was a psychic response, but since it was a favorable one I thought no more about it. About six months later, he returned with a pain in his back, less than before, but definite. Again I found a small piece of tissue, even lower down on the posterior pharynx, and this was cauterized. Again he exclaimed, "My pain has gone " I was doubly sure that this was again a psychological effect, as only in this patient had I ever obtained such an instantaneous result. Many patients had gradually lost their pains after several cauteries; but this was so prompt, I could not believe it was possible. Again, about a year later, he returned with a slight pain in his back, and expressed a desire to have me look into his throat for more tissue. Determining to prove to myself whether this was just so much hocus-pocus, I examined his throat and told him I saw another small infected spot, although I saw nothing pathological. I cauterized his posterior pharynx at about the region of the last cautery, but there was no relief. I looked again, and told him there was another small spot, whereupon I again cauterized some normal mucosa. Nothing happened to the pain. Feeling that possibly the patient may have been correct on his previous visits, I pressed the tongue very low and there on the posterior hypo-

pharynx was really a small piece of infected tissue The moment this was cauterized the back pains disappeared. It was as if a string from the throat to back was cut, so instantaneously was the pain relieved. To date, more than a year now, there has been no recurrence.

Case 3: A young married woman, about 28 years of age, complained of pain in her lower back. Examinations by her internist and gynecologist failed to reveal any causative factor and relief was obtained only temporarily with salicylates, heat, hot douches, etc. X-rays of the spine were negative for pathology. My examination revealed a small amount of infected tissue in her right tonsillar fossa and on the posterior pharynx and lingual tonsil. These tissues were cauterized with complete relief of her pain.

Case 4: Case of a young boy, 11 years of age, with chorea following acute rheumatic fever, and a cor bovinum. This child had the worst case of chorea I have ever seen, constantly tossing, and twisting practically every part of the body all the time for one year, and a heart that filled his entire chest. His tonsils, enlarged and grossly infected, were the only foci of infection found. A tonsillectomy and adenoidectomy were performed under ether anesthesia and within a month the chorea had disappeared. The heart returned to a normal size and the patient is now a Major in the Army.

Case 5: A Sergeant in the Army, stationed in Washington, complained of a sharp, penetrating pain in the right side of the throat about the level of the larynx, of several years' duration. The pain was present most of the time and caused much distress. Nothing was found to account for it, and all forms of therapy failed to give relief: Heat, diathermy, local injections of novocaine, analgesics, sulfonamides, local applications of antiseptics, etc., failed to relieve the pain. The tonsils had been removed some years before, but there was some infected tissue in the fossae and there was also a small amount of infected lingual tonsil present. This tissue was cauterized with relief of the pain and the patient stated that life was worth living again.

Ofttimes the lingual tonsil is situated far down on the back of the tongue and presses against the epiglottis. This causes a cough in some patients; in others, a feeling of something in the throat which they try to get rid of by constantly clearing their throats. This, of course, they cannot do and it becomes an annoying habit. Cautery of this tissue will give complete relief of the cough or of the clearing of the throat in practically all of the cases in which it is the only cause. In all cases in which no cause is found in the chest or larynx or sinuses, a lingual tonsil should be suspected. This condition is probably due to an irritation rather than to a focal infection in these cases.

Many cases of iritis, retinitis and corneal ulcerations have been cured by removal of the tonsils, both faucial and lingual. This was after sinus treatments and operations had failed to

give relief. I have also relieved several cases of toxic labyrinthitis by similar methods, when all other forms of therapy have failed. At times it is possible to remove much of the lingual tonsil with a small guillotine or snare, and any remaining tissue can be cauterized. Personally, I use the actual cautery, or electrocautery, which is a flattened-out platinum wire, at almost white heat. Cocaine 10 per cent, or other tropical anesthetic, is applied by cotton applicator and within 10 minutes there is sufficient anesthesia to perform the cauterization. The patient holds his tongue with a piece of gauze between the thumb and index finger, while I use a laryngeal mirror in my left hand and the cautery in my right hand. About four to six areas are cauterized about once a week. One can use novocain by injection instead of the topical applications, and electrodesiccation instead of cautery if desired.

Although it is advisable to remove all of the foci of infection from the pharynx, occasionally elimination of just a small amount of infected tissue may give relief. This was true in Case 1, in which the patient obtained relief by cauterizing only a small amount of infected lingual tonsil. This may be explained by the fact that the patient may be able to tolerate a certain amount of toxin without symptoms, but that any excess of toxin may cause symptoms. By cauterizing even a small amount of infected tissue, the excess toxin may be eliminated, thus relieving the symptoms.

Iodine (hydriodic acid, iodides, lipoiodine tablets) may be prescribed, as this will often reduce the size of the lymphoid tissue, but a cautery is necessary to effect removal and to eliminate the infection.

SUMMARY.

1. Tonsils do not constitute the only foci of infection in the pharynx.

2. Other foci are lingual tonsils, adenoids and lymphoid tissue on the posterior pharyngeal wall.

3. In conditions due to focal infection, all of the foci in the pharynx should be removed, but relief is often obtained when only a small amount of the infection is removed.

4. Cases are cited in which relief of pain was obtained when the infected tissue in the throat was removed either by operation, cauterization or electrodesiccation.

5. Lingual tonsils are often the cause of cough.

6. Iodides often aid in the reduction in size of lymphoid tissue in the throat.

1835 Eye Street, N.W.

WHAT CAN A COUNTY MEDICAL SOCIETY DO WITH AN EXTRA $500 ANNUALLY?

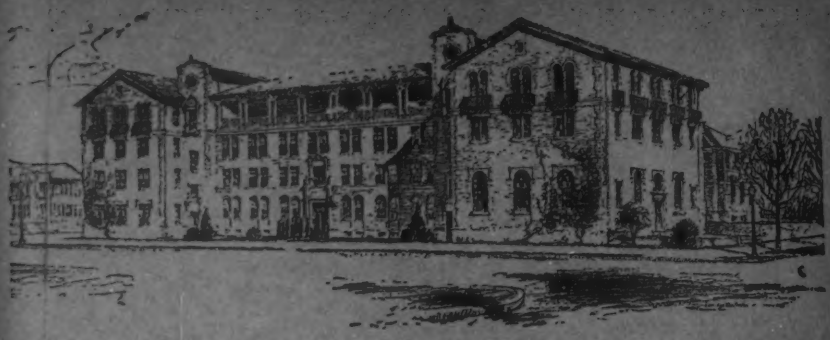
A few years ago a member of the Adams County Medical Society of Illinois (membership of 60) set up an irrevocable trust (foundation) for his society and has since contributed to it so that the income is now over $600 annually. The principal must be held intact, and not to exceed 80 per cent of the income may be expended annually, so the foundation will naturally grow. The trustees are empowered to use the funds "to sponsor or undertake one or more things of a charitable, scientific, literary or educational nature" and "which will bring public and professional honor and respect to the medical profession." The trustees know of no other foundation that has been set up like this one and are very desirous to secure counsel. Further particulars relating to the foundation may be had, or any suggestions for activities may be sent, by addressing Dr. Ralph McReynolds, President, Swanberg Medical Foundation, 1101 Maine Street, Quincy, Ill.

COURSE IN AUDIOMETRY AND FITTING OF HEARING AIDS.

The State University of Iowa will offer as a feature of its full program in speech pathology and hearing conservation, during the 1946 Summer Session, an intensive course in audiometry and the fitting of hearing aids. The course will run from June 17 to July 29 and is designed to train technicians as lay assistants to otologists; school nurses in public school hearing testing; executive secretaries in leagues for the hard of hearing; and others interested in hearing conservation. Any person who meets college entrance requirements is eligible. The first 24 students whose applications are received will be accepted for the course. Applications may be made to Prof. Wendell Johnson, Director of the Speech Clinic, University of Iowa, Iowa City, Iowa.

MISSISSIPPI VALLEY MEDICAL SOCIETY TO MEET IN ST. LOUIS, SEPT. 25, 26, 27, 1946.

The eleventh annual meeting of the Mississippi Valley Medical Society will be held Sept. 25, 26, 27, 1946, at the Hotel Jefferson in St. Louis. Due to the fact that no meeting was held in 1945, all the officers of the society have been retained for another year. These include the president, Dr. Grayson L. Carroll, of St. Louis; president-elect, Dr. Walter A. Sternberg, of Mt. Pleasant, Iowa; first vice-president, Dr. Louis H. Jorstad, of St. Louis; second vice-president, Dr. Elmer E. Nystrom, Peoria, Ill; third vice-president, Dr. E. J. Lessenger, New London, Iowa; secretary-treasurer, Dr. Harold Swanberg, Quincy, Ill.



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DR. HELEN SCHICK LANE, Principal

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